the OIL AND GAS JOURNAL

10 TIMKEN® bearings lick heavy loads and dirt—100 miles from nowhere

GEORGE E. FAILING COMPANY uses ten Timken bearings in these key assemblies in the "CFD-1" Holemaster: drawworks gear box, rotary table, water swivel.

THE "CFD-1" Holemaster drills shot holes 1000 feet deep and drills them fast. To assure dependability out in the middle of nowhere, George E. Failing Company, the manufacturer, uses a total of 10 Timken® bearings—in drawworks gear box, rotary table and water swivel. Timken bearings also are used in the mud pump.

The rotary table must sometimes take the full weight of the drill string. This produces a heavy thrust load. So the table is mounted on Timken *tapered* roller bearings which take both radial AND thrust loads in any combination. No extra thrust bearings are required.

Timken bearings help solve another drilling headache—mud and water. Because of their extreme precision, the Timken bearings keep all parts concentric with their related components. This makes for more effective closures. Lubricant stays in, and dirt, dust and moisture stay out.

The Holemaster is completely mobile—compact and efficient. Timken bearings help—they permit compact assemblies because they have high load-carrying capacity for their size. One reason: full line contact between rollers and races.

On any machinery, Timken bearings mean longer life, less maintenance, less friction. To give you the finest quality, we even make our own bearing steel. We're the only bearing manufacturer that does. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

TIMKEN
TRADE-MARK REG. U.S. PAT. OFF.
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ○ THE TIMKEN TAPERED ROLLER ○
BEARING TAKES RADIAL ○ AND THRUST ○ LOADS OR ANY COMBINATION

PRICE 50 CENTS

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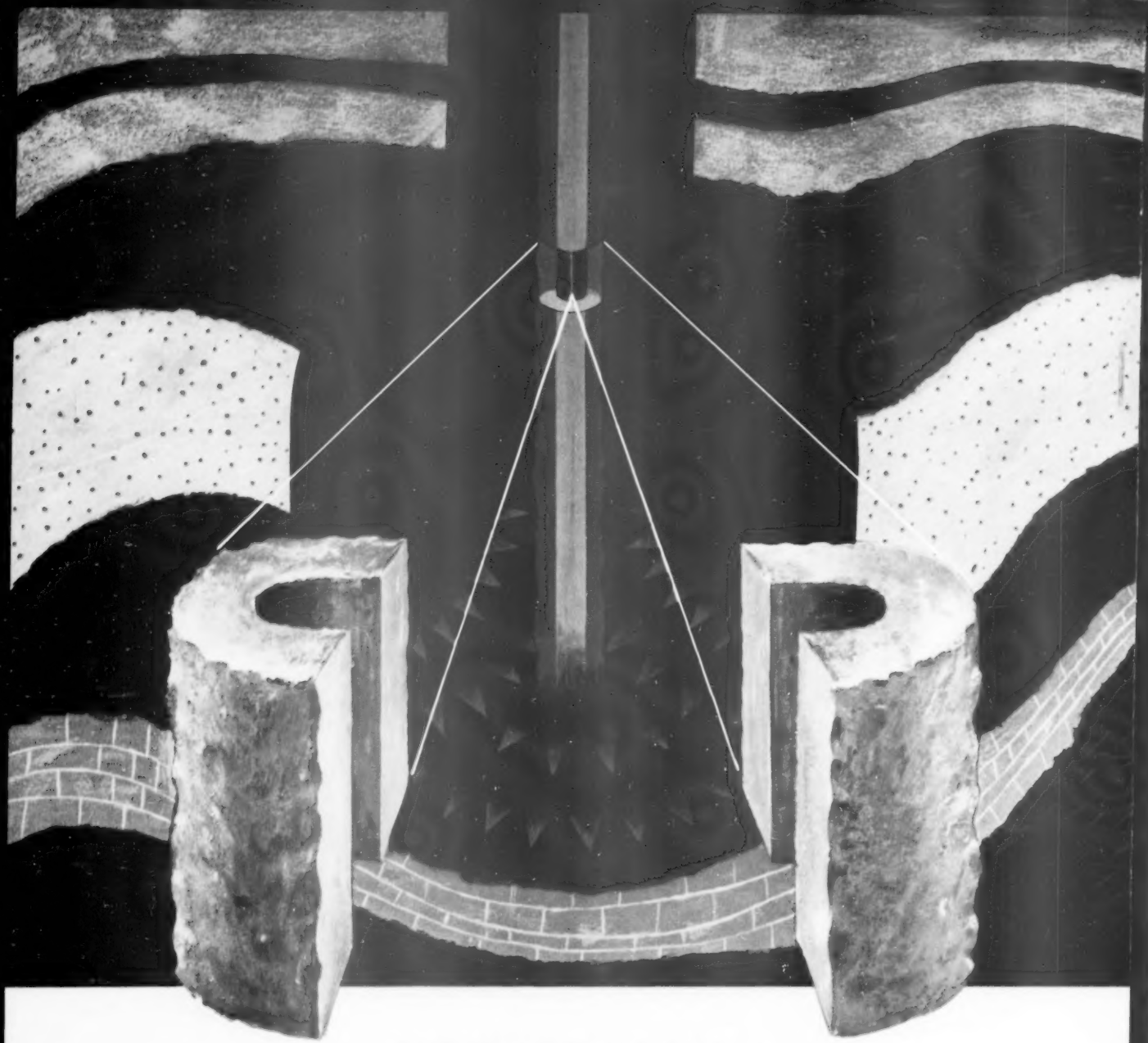

CEMENTING

is the complement of drilling

As the churning drill bit chews a hole through water-bearing formations, it destroys the natural barriers that held these waters captive. And that creates cementing's job . . . to restore these barriers as well or better than before, and to form a bond of cement between wall and casing as though no hole were there. When drilling is done with cementing in mind both jobs are more successful. Halliburton will gladly advise you prior to drilling on the many factors that affect cementing. This advice, based on million-job experience and 25 years' extensive research, may save you time and money and help increase production. More and more operators wisely regard Halliburton cementing as the complement of drilling.

"THERE'S NO SUBSTITUTE FOR EXPERIENCE IN OIL WELL CEMENTING"

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL

MARCH 1, 1954 VOL. 52 NO. 43

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In Brief . . .

1. BETTER MEASUREMENT . . . The capacitance recorder holds promise of wide application in the solution of pipe-line measurement problems. In crude-oil pipe lines, it has the ability to detect and record the presence and quantity of b.s. and w. within limits heretofore considered impossible in normal practice. In products pipe lines, its ability to detect the product interface suggests wide use for that purpose alone.

2. MORE INFORMATION . . . The dynamometer as a tool for collection of pumping-well information pays off in reduced well-repair expense and can be used to arrive at minimum pumping-equipment requirements in new wells. The instrument can be used to measure well loads and polished-rod horsepower, information which is used in selection of equipment and over-all study of equipment performance. Detailed analysis of the dynamometer card leads to simplification of remedial analysis of wells having high repair expense and simplification of the general solution of pumping problems.

3. ECONOMICAL STORAGE . . . Lion Oil Co.'s experience with underground storage of volatile hydrocarbons indicates that storage in salt formations can be developed at a cost of less than $1.00 per barrel. This renders the seasonal storage of large volumes of L.P.G. economically feasible. On the basis of 1952-1953 L.P.G. price experience, and operating expense of $0.125 per barrel, it is estimated that a net profit of approximately $0.147 per barrel stored and recovered can be expected as the result of sales price appreciation, thus proving method's feasibility.

4. MORE OIL PRODUCTION . . . After 4½ years of hydraulic fracturing, these conclusions may be drawn: (1) where there are zones of reduced permeability around the well, fractures bypassing this zone increase the producing rate, and in many instances the ultimate recovery; (2) the permeability range within which deep fractures take on practical significance may tentatively be defined as falling between 0.1 and 5 md. as normally reported on cores; (3) well spacing required for the development of extremely tight formations seems to be controlled by ability to extend fractures; and (4) in more permeable reservoirs where water may be used as a driving agent, deep penetrating fractures result in severe channeling.

PREVENT COSTLY VAPOR LOSS and BUCKLING *with* **OPW**

TANK VENTS

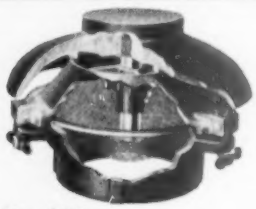
There's a Vapor-Saving OPW Tank Vent for every purpose. They are your INVESTMENT against high volatile vapor loss due to product expansion and temperature variation. Weighted to specifications, they trap and hold vapors and release only at set pressures, which insure maximum protection and dollar dividends. Double mesh screen . . . readily accessible for inspection prevents flame from following vapor into tank maintains bulk storage safety at the highest level.

OPW No. 95—precision machined, product engineered for lifetime use, characterizes the rugged, simple construction common to all OPW Tank Vents. Available: 2" - 3" - 4" - 6" - 10"

Send for the OPW Tank Venting and Emergency Relief Recommendation Chart!

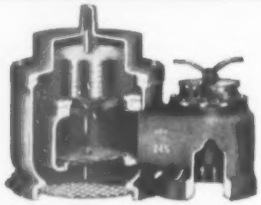
OPW MANUFACTURES VENTS FOR ALL SIZES and TYPES OF TANKS

Small Home-Storage Tanks | **Farm Skid Tanks** | **Under-ground Storage Tanks** | **Above-ground Storage Tanks**



No. 209

Emergency escapement vent, for relief of pressure only. Used in conjunction with vacuum vents.



No. 245

Combination pressure, vacuum vent. 4", vacuum ½ ounce-pressure, 2 oz. to 2 lbs. 6", vacuum ¼ ounce-pressure, 1½ oz. to 1 lb.

OPW CORPORATION FOR HANDLING HAZARDOUS LIQUIDS · VALVES · FITTINGS · ASSEMBLIES · CINCINNATI 25, OHIO

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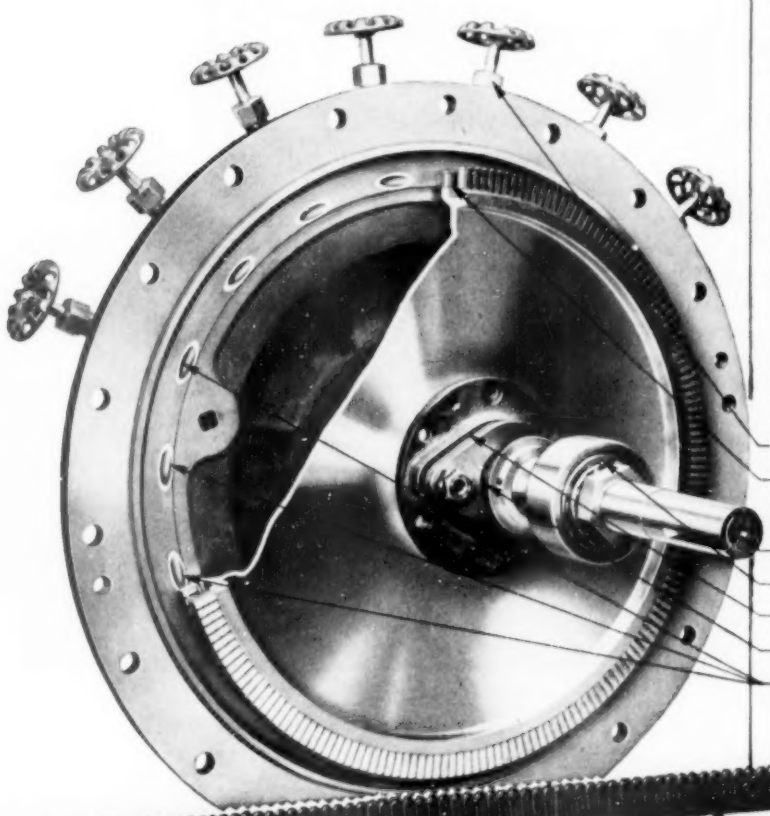
2731 Colerain Ave. • Cincinnati 25, Ohio

No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



- 7 hand valves for efficient partial load operation, (20" turbine shown)
- 2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced
- 30-40 carbon steel shaft
- Oversized double row deep grooved ball bearing
- Stuffing box with metallic packing ring
- Heavy chrome plating of shaft through stuffing box
- 3 nozzles always open

Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORP.,
263 Park Avenue, Worcester 2, Mass.

Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

A message to the Oil Producer who contracts the drilling of his wells:

The type of drilling equipment your Contractor proposes to use is of major importance to You!

If it's to be a DEEP well . . . and your contractor tells you that he will put an "Oilwell" No. 96 Rig on the job with "Oilwell" No. 220-P Pumps and companion "Oilwell" heavy-duty equipment, you can be sure that you are being offered the services of a rig that can go to 16,000 feet with 4½" drill pipe—and deeper with 3½".

For MEDIUM-DEEP drilling . . . an "Oilwell" No. 76 Rig with companion "Oilwell" equipment including No. 218-P Pumps can be depended upon to give you equally satisfactory performance to depths of 10,000 feet.

And for MEDIUM depths . . . you can count upon "Oilwell's No. 66 or 63-T Rigs, equipped with No. 214-P Pumps and companion "Oilwell" equipment. to do a fine job to depths of 7,500 feet.

Branches Serving All Oil Fields

You can depend . . . on the DRILLING CONTRACTOR who puts "Oilwell" Rigs on your jobs. He is capable and reliable . . . and is giving you the RIGHT rig for BEST results.

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Branches Serving All Oil Fields

USS TRADE MARK

"OILWELL" TRADE MARK

UNITED STATES STEEL

it's AMERICAN

any way you figure it...

Yes, there is an American Pumping Unit to fit *your* needs. American Pumping Units, from the husky T5 to the giant T27, are engineered to do a *specific* job. There is an American Pumping Unit for *every* job—for every well. The new American Pumping Units have adjustable cranks that make it an easy one-man job to adjust the counterbalance. Any way you figure it, it's more profitable to specify and use American Pumping Units.

AMERICAN
MFG. CO OF TEXAS
FORT WORTH 11, TEXAS

- Odessa
- Tulsa
- Kilgore
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- New York
- Calgary, Alberta, Canada

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"Save money?

Sure!"

THAT, in a nutshell, tells you why so many wire rope users in the oil fields prefer Roebling wire rope... it speeds up operations... lasts longer on the job ...saves money that really adds up.

For the last word in wire rope efficiency and economy, call your nearest Roebling office or distributor for a Roebling recommendation.

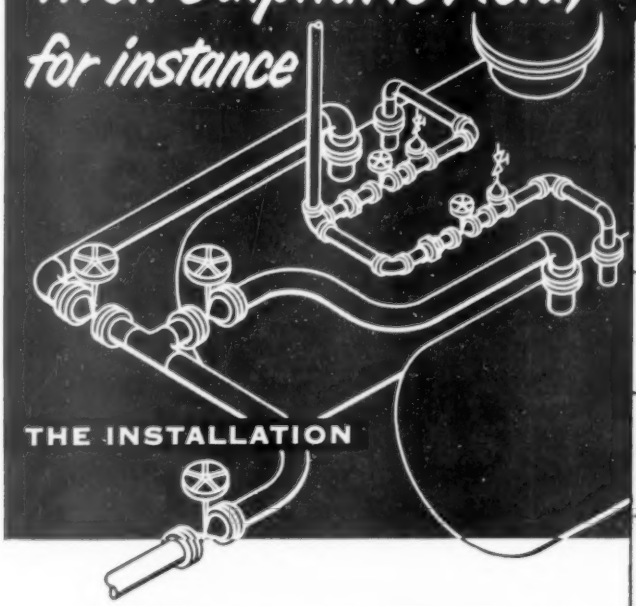
ROEBLING CF

A subsidiary of The Colorado Fuel and Iron Corporation

THERE IS A ROEBLING DISTRIBUTOR NEAR YOU

Model Behavior for Steel Valves

...on Sulphuric Acid, for instance



At a leading Gulf Coast lube oil plant, using Crane steel valves on lines to concentrated sulphuric acid storage and blow cases.

VALVE SERVICE RATINGS

SUITABILITY: Giving full satisfaction

FEATURES: Compact bolted-bonnet design

MAINTENANCE COST: Routine service only needed

SERVICE LIFE: In lines more than 2 years

OPERATING RESULTS: Safe control of acid – no loss

AVAILABILITY: Catalog item – No. 3607X

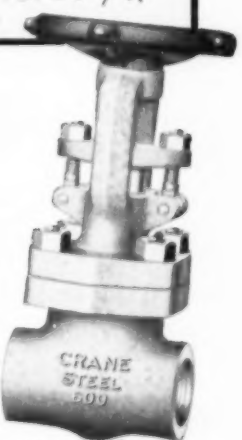
THE CASE HISTORY

Valves formerly used in this service showed severe corrosion a few months after installation. Both stems and seats were affected, with early leakage resulting. Longest life of any of these valves was less than one year.

Replacement was made more than 2 years ago with Crane No. 3607X steel gate valves. By effectively sealing against atmospheric condensation, the deeper Crane stuffing box prevented dilution of acid and resultant stem corrosion. Wider seating surfaces give Crane valves higher resistance to seat corrosion and leakage. They're still in service; show no loss of efficiency. That's the result of thrifty buying—when quality is the first consideration.

THE VALVE

You'll find big valve features in these Crane 600-pound bolted bonnet, small steel gates. They fill every need for quality, compact design, maximum strength with no excess weight. Easy to use; easy to service. Sizes, ½ to 2 in.; screwed, flanged, or socket-welding ends. See your Crane catalog or your Crane Representative.



THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

SQUEEZES BEST UNDER DIFFICULT CONDITIONS!

HALLIBURTON'S *hydraulic* RETRIEVABLE CEMENTER

Squeeze cementing becomes a simple and economical operation by using this time-saving tool . . . because the Retrievable Cementer is built to perform efficiently under the highest pressures and most difficult operating conditions.

Halliburton's Retrievable Cementer is operated hydraulically. Fluid pressure applied to tubing or drill pipe sets slips and packer rubbers. The rubbers are compressed to set position by a hydraulic piston, actuated by the same fluid pressure. Slips and packer rubbers are locked in set position, making it unnecessary to maintain pressure on the tubing.

Besides being *retrievable* it has many features that add up to substantial savings in rigtime:

★ **The tool can be run in rapidly without overflow of fluid in tubing. Friction drag blocks allow tool to be started easily.**

★ **Tubing may be tested to 10,000 p.s.i. while setting packer. Lower end of stinger is blanked off while slips are set, eliminating need of a tubing plug or ball.**

★ **Sand bridges encountered while going downhole can be washed out by reverse circulation.**

★ **Tool is operated by simple drill stem manipulation. It operates by up and down movement of tubing, after circulation valve is turned to right and lowered to remove lugs from locked-open position.**

★ **Packer can be set, released, and re-set without coming out of hole.**

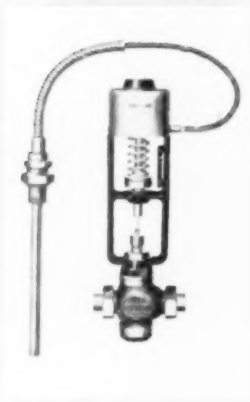
★ **Spring-loaded safety joint allows tool to be rotated out of hole. This automatically opens circulating valve so tubing is pulled dry.**

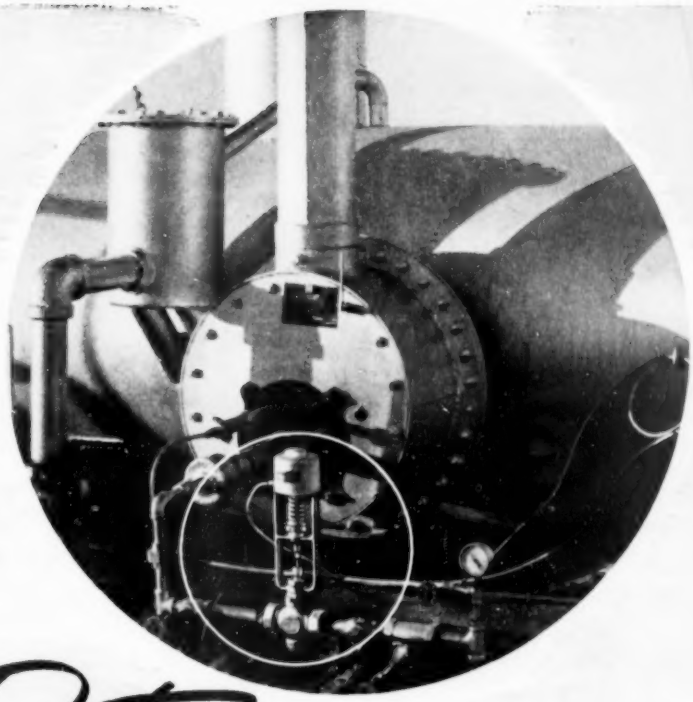
The Hydraulic Retrievable Cementer means rigtime saved and better squeezing under most difficult operating conditions. Take advantage of its many valuable features on your next job. Phone your local or district Halliburton office. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

CEMENTING SERVICES

THERE'S NO SUBSTITUTE FOR EXPERIENCE IN OIL WELL CEMENTING!





On Duty 'ROUND THE CLOCK . . .

AMERICAN TEMPERATURE REGULATORS

The temperature of this oil treater is *constantly* maintained within prescribed limits. Such safe, dependable service is assured by the self-operated, precision-built American Temperature Regulator. A turn of a conveniently placed adjustment nut sets the temperature. And, to duplicate any setting easily and quickly, a scale is mounted on the Regulator frame. Between the bellows and adjusting spring is a safety spring that protects the Regulator if the bulb is accidentally subjected to excessive temperature. Damage and disturbance of the set temperature are prevented by heavy armor that safeguards the capillary tubing and seamless bellows.

American Temperature Regulators give positive temperature control of oil, water, steam and other media — help maintain product quality and reduce costs. Sizes range from ¼" through 4". Two types of valve action available: *direct action* for use in *heating* processes; *reverse action* for application in *cooling* processes. Both types are ruggedly constructed, efficient and dependable. Bulletin 112 contains complete data, including selection tables. To be certain of safe, economical processing, let your nearby American Instruments Distributor help you choose the right American Temperature Regulator for your needs.

PERSONAL SERVICE is the policy of your Industrial Supply Distributor. He stocks Manning, Maxwell & Moore and other products in types and sizes you need to avoid delays and inventory costs.

AMERICAN INDUSTRIAL INSTRUMENTS

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

IN TEXAS George Novak, sales engineer (left), talks with a driller about field handling of casing and drill pipe. Here he discusses a new product development with the director of an oil company drilling engineering division.

In The Oil Fields . . .

It's Extra Service That Counts

You play for big stakes in the oil fields. Every drilling operation is a gamble and you are continually striving to reduce the odds.

That's where Pittsburgh Steel's sales engineers fit in. If you drill for and produce oil, the sales engineer's job is to make sure that you are satisfied and happy with every length of Pittsburgh drill pipe, casing or tubing you receive and that it gives you the kind of service you want in the field.

In one day the sales engineer's range of assignments may include: (1) Computing specifications and designing oil strings for independent operators who do not have engineering staffs, (2) taking orders, (3) making sure the operator is satisfied that shipments meet specifications, (4) assisting field shops in the proper threading

IN OKLAHOMA Sales Engineer Jewel Smith (right) checks threading to make sure that . . . Pittsburgh Steel products will perform satisfactorily for all types of drilling and production.

of tubular material and application of necessary field equipment, (5) schooling field crews in proper handling and installation, and (6) observing the running of casing and tubing to insure proper performance.

Beyond that, they frequently will be working with other engineers and drillers on the technicalities of a planned drilling operation. Often they are busy developing new products or introducing new products to drilling contractors and engineers.

George Novak (above) from Houston, for example, helped to develop a new tubing for use on high pressure completion jobs. He and an engineer for an oil company jointly worked out the specifications for tubing capable of withstanding excessive working pressures. That tubing put the oil company, and eventually the industry, years ahead in development. For Novak, it was one more in a long and impressive string of oil field "firsts" he has worked on.

● **It has to be right**—Recently John Wais Jr. (right) from Los Angeles, has been working with operators who are using Pittsburgh's lightweight, high-strength seamless drill tubing to reduce drill pipe weight. Field requirements and mill problems have to be coordinated to work out the most suitable dimensions and designs. Wais goes over these requirements with customers, makes suggestions on the design and explains what can be done by the mill to obtain the best product for these requirements.

Jewel Smith (left) from Tulsa, is busy giving the same kind of service, ranging over thousands of miles, to visit oil men on the job. This 215 pound, six-foot-three, former oil field "roughneck" can't walk past a quantity of stored Pittsburgh Steel products—already sold and delivered—without getting measuring devices out of his car and testing to make sure the customer is getting what he asked for.

IN CALIFORNIA On arrival of a shipment of casing, Sales Engineer John Wais Jr. (center above) works with inspecting crews to be sure they are satisfied. The same day finds him (below) discussing technical problems with a drilling superintendent and drilling engineer for an oil firm.

Sales engineers like Novak, Wais and Smith are the liaison men between Pittsburgh Steel's steel mills and the oil men's field operation. If you have a problem that involves the use of drill pipe, casing, or tubing, or other operational problems—these men, plus the sales staff and the mill men at Pittsburgh Steel—are ready to do what they can to help you arrive at the right answer.

And you can count on them to follow through to see that performance on the job is up to your expectations. They know that, after all, it's the follow-through that counts most in the oil fields.

"Everything New But The Name"

Pittsburgh Steel Company

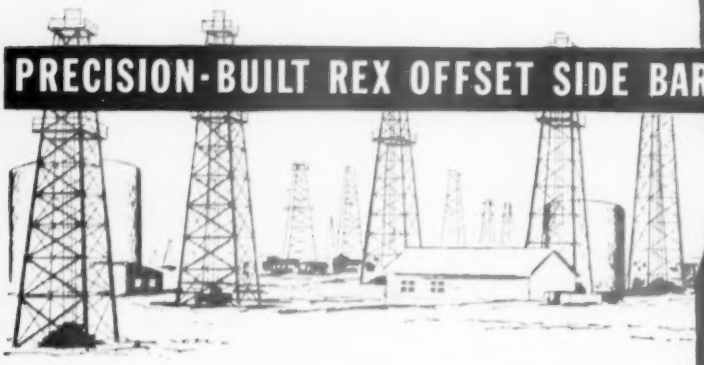
Grant Building • Pittsburgh 30, Pa.

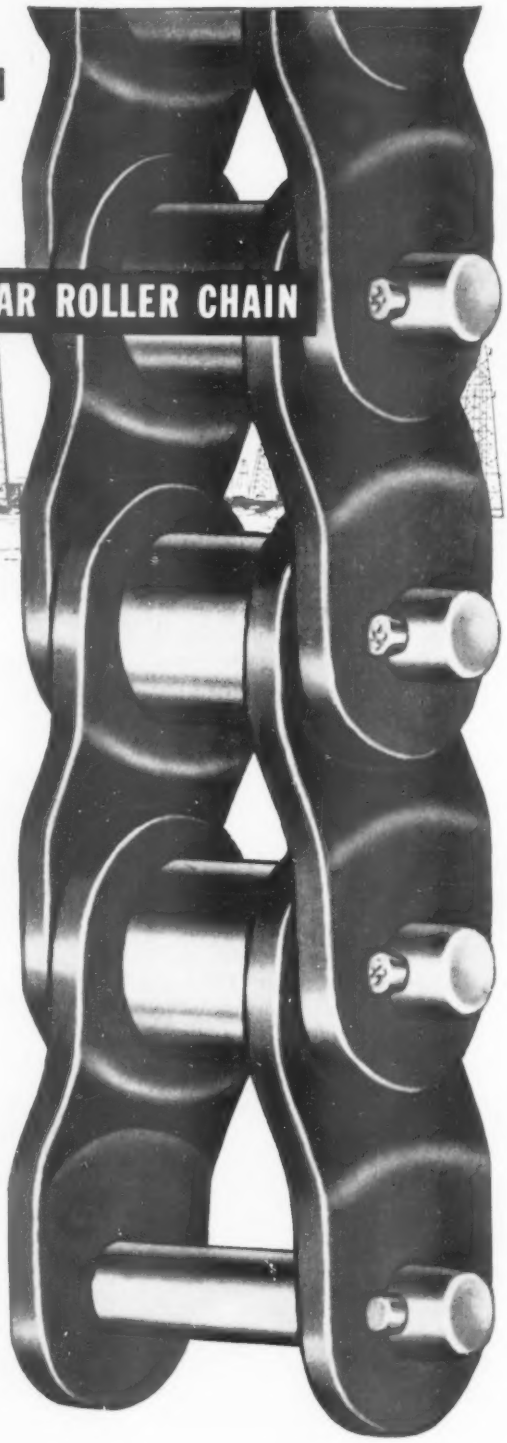
Sales Offices in Principal Cities Throughout the Country

A Great OIL FIELD CHAIN

NOW BETTER THAN EVER!

PRECISION-BUILT REX OFFSET SIDE BAR ROLLER CHAIN





Rex Offset Side Bar Roller Chain, for years a favorite in the oil fields, is now better than ever. Improved materials plus the finest manufacturing techniques and heat treatment make it the ideal chain for high-speed, low-cost drilling. It is built to the same exacting tolerances and finishes as highest quality standard roller chain.

And you still get these outstanding Rex features . . .

- ★ **It's built to take it . . . built-in clearances between working parts enable chain to operate under the toughest conditions.**
- ★ **Pins are heat-treated to resist shock loads. All parts are highly finished.**
- ★ **It's easy to couple and uncouple. Links exactly alike. No special coupler links to deal with. Can be lengthened or shortened by adding or removing only 1 pitch.**
- ★ **It comes boxed in convenient 10-foot lengths.**
- ★ **Runs over same sprockets as standard A.S.A. roller chain. Available from 1¼" to 2" pitch in single and multiple strands.**

For all the details write for Oil Field Chain Bulletin No. 52-3. Chain Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT REX COMPANY ®

Chain Belt COMPANY OF MILWAUKEE

OIL FIELD SALES OFFICES

New York • Tulsa • Dallas • Houston • Midland • Los Angeles

"Sold in leading supply stores throughout the oil country."

PICTURE OF REPUBLIC ENDURANCE

When this picture was shot the hose had drilled continuously for two tough years and was still in good condition.

To a man in a hurry at the time of purchase the name on a hose may seem unimportant. But the fact remains that . . .

Hose Lasts Longer
when the brand is

REPUBLIC

—Rotary
—Vibrator
—Suction

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
SUPPLY DIVISION

Serving The United States and Canada
General Offices: Tulsa, Oklahoma
J&L Tubular Products and Wire Rope

PESA
PARTNERS IN PETROLEUM PROGRESS

*FIRST LINE *Extended-Surface* HEAT EXCHANGERS

ASK THE AEROFIN MAN

Specify Aerofin and you specify high efficiency, long service life and low maintenance and service costs.

Take advantage of Aerofin's unequalled experience, production facilities, and materials-testing and design research—of Aerofin's complete engineering service at the plant and in the field.

Ask the Aerofin man.

* Aerofin makes extended heat surface exclusively — not as a by-product, not as a side-line. Sold only by manufacturers of fan-system apparatus. List on request.

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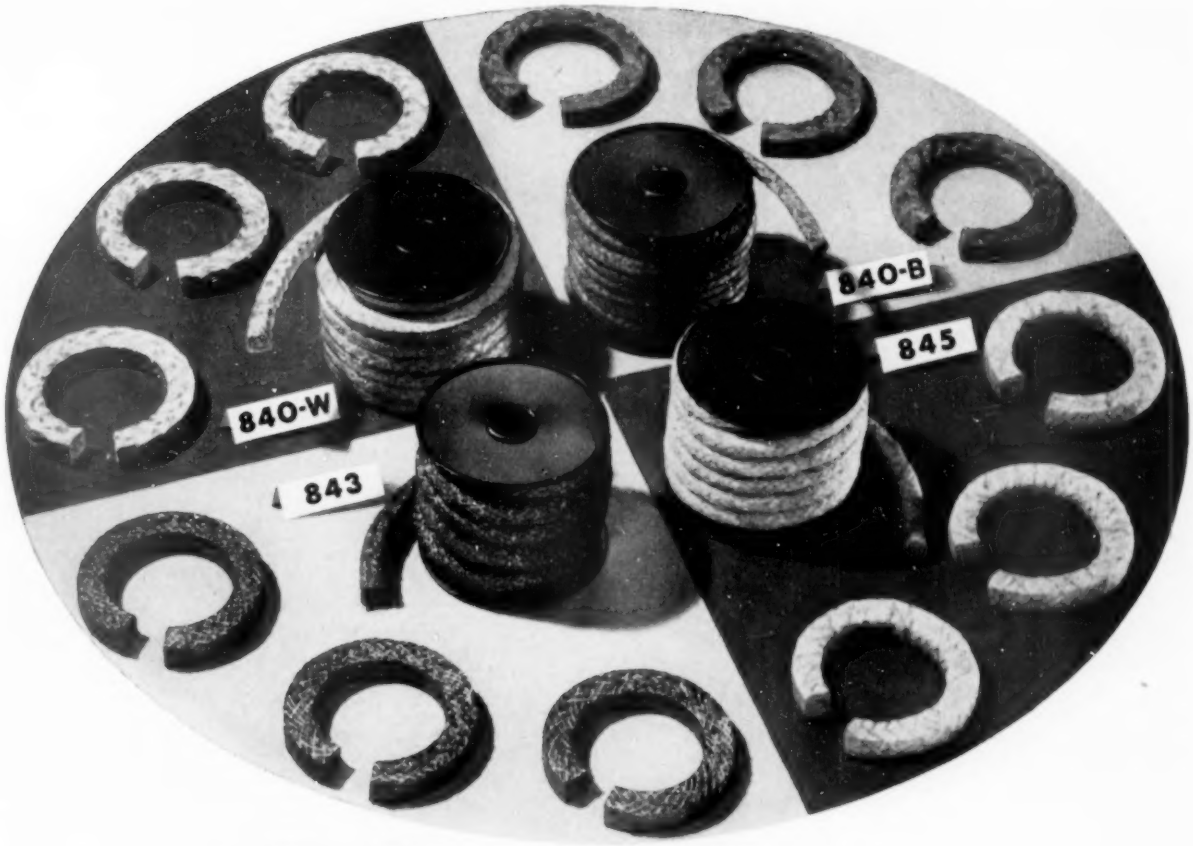

Why R/M Teflon* Packings are so right for chemical pumps and valve stems

Consider first the virtues of "TEFLON":* it shows no reaction to chemicals within the temperature range of −80° F. to 500° F.; it is unaffected by any known industrial acids or caustics; it has no known solvent; it is nonadhesive and noncontaminating; its water absorption is zero, and weather does not affect it.

In R/M Packing No. 843, "TEFLON" is combined with South African blue asbestos. Together they make a terrific pump packing—a sealing team you can count on to handle acids and corrosives up to 220° F.—except nitric. The asbestos compensates for "TEFLON's" high thermal expansion and makes lubrication saturation possible.

R/M Packings Nos. 845, 840-B and 840-W are for valve stems. No. 845 is an all-"TEFLON" braided packing that is absolutely foolproof for chemicals and solvents up to 500° F. It is always recommended when the nature of the material being handled can not be revealed. For some applications the same sealing effectiveness can be obtained, however, at a lower price with No. 840-B or No. 840-W . . . both of which contain asbestos. No. 840-B is ideal for use against corrosives and acids; No. 840-W against solvents and oils . . . and also where food contamination is a problem.

For complete information, write today.

**Du Pont's trade-mark for its tetrafluoroethylene resin*

R/M MAKES A COMPLETE LINE OF PACKINGS AND GASKETS—AVAILABLE FROM YOUR AUTHORIZED R/M DISTRIBUTOR

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RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

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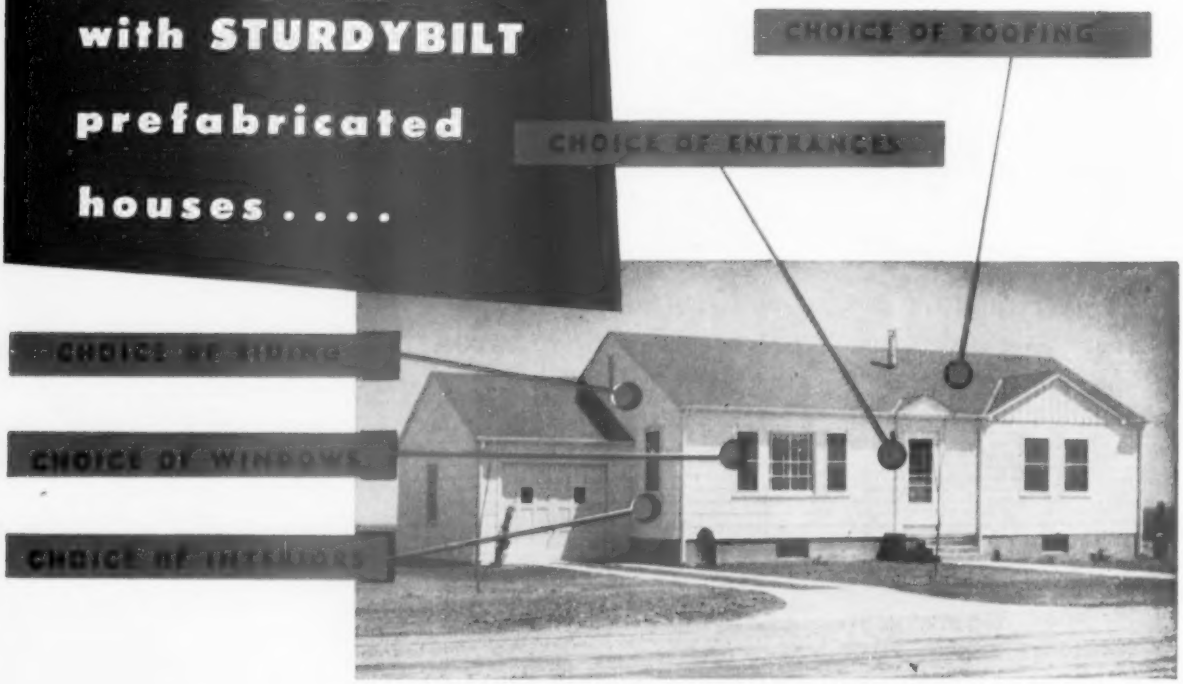
CUSTOM-BUILT INDIVIDUALITY with STURDYBILT prefabricated houses....



STURDYBILT Houses do not all look alike. Even the appearance of models with the same elevation and floor plan can be changed with different type siding, roofing, windows, entrances and interior finish.

MANUFACTURERS OF SPECIAL MILLWORK: DISTRIBUTORS OF CURTIS WOODWORK AND JOHNS-MANVILLE BUILDING MATERIALS

CURTIS Kitchens are now available in STURDYBILT Houses in order to give the family the finest in design and convenience. Any type of roof covering from rolled roofing to Johns-Manville asbestos shingles can be obtained for any STURDYBILT House.

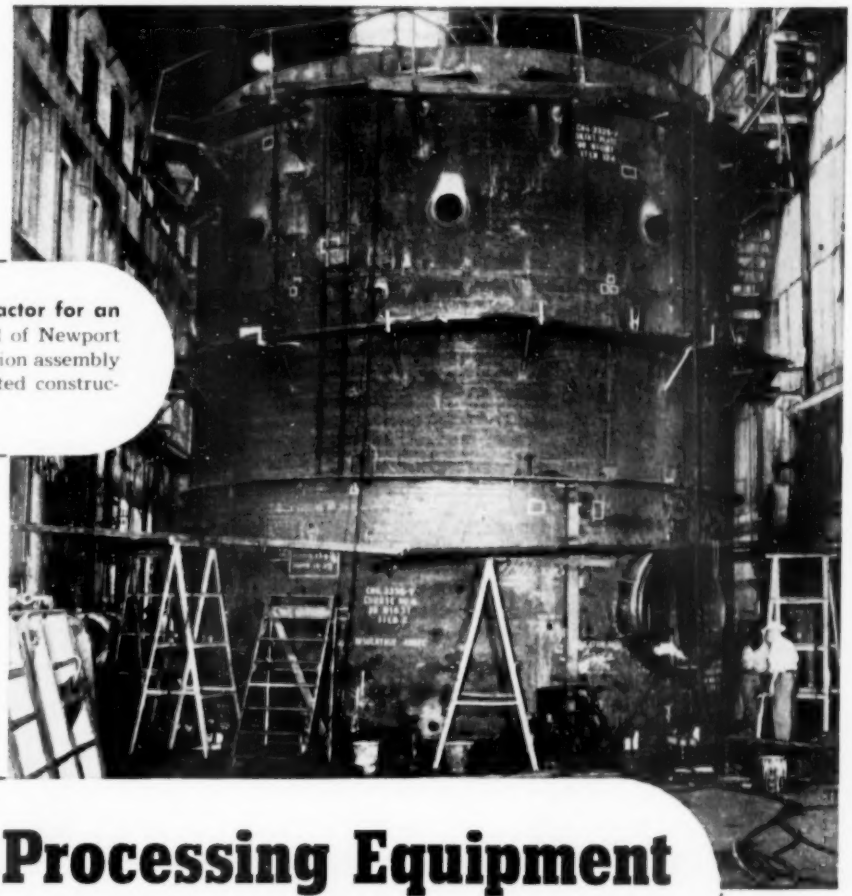
Make your oil field camp a beautiful, planned community. You can do it by taking advantage of the many custom-like features of STURDYBILT Prefabricated Houses.

WRITE FOR INFORMATION

STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES



Course number four of a reactor for an overseas oil refinery. Typical of Newport News plant methods, the precision assembly of this unit in the shop expedited construction of the reactor in the field.

Petroleum Processing Equipment

. . . Built by Specialists in Metal Fabrication

Careful attention to detail characterizes the work of Newport News craftsmen...

They've fabricated millions of tons of steel including corrosion-resistant alloy, clad and other special steels for many diverse industries.

Newport News handles the job exactly as you want it done, for maximum results per dollar invested.

Specialized production techniques, advanced plant methods and a complete range of facilities along with many special purpose machines contribute to the excellence of Newport News fabrication.

Let us bid on equipment for your present or future projects. Learn how Newport News can help you...send for our booklet entitled "Facilities and Products." It's yours for the asking.

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Newport News, Virginia

Here, at the Scintilla Division of Bendix, the word SERVICE is much more than the name of a department. It is a vitally important part of our over-all operations. Together with Research, Engineering and Manufacturing—Service might well be termed the fourth dimension of our business.

To implement this policy of following through to see that every customer gets the full performance built into each product, the Scintilla Division has a world-wide service organization backed up by factory-trained service men strategically located to meet service emergencies.

Service data, covering installation, operation and repairs as well as adequate distribution of parts, makes up a complete service program.

Just another reason why the name Bendix has become "The Most Trusted Name in Ignition."

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Our planes and pleasure cars . . . our farms and factories . . . our prosperity and our national progress owe their continued development to oil. Helping in the search for new oil resources are the Schlumberger research scientists who are continually exploring possible new applications of modern science to problems of the oil industry.

. . . and Schlumberger means Service

Schlumberger Well Surveying Corp. • Houston, Texas

Do you have this MARVEL Inverse Oiler

on your { GASOLINE / BUTANE / or / DRY GAS } engine?

then you should use this MARVEL MYSTERY OIL in the Oiler!

Here's a carefully engineered pair to improve performance of any engine . . .

The *Marvel Inverse Oiler* is designed to feed *Marvel Mystery Oil* in exact proportion to engine speed and load. Prevents excess wear on valve stems and guides . . . keeps upper piston rings free to move in their grooves . . . retards ring flutter . . . and cushions ring pounding which can result in ring breakage. In addition, *Marvel Mystery Oil* reduces cylinder wall wear, and gives assurance against valves sticking. Remember, it is *the oil* which must do these things and only *Marvel Mystery Oil* is blended for this purpose and for this oiler. Over 30 years of exceptional performance.

This Chart shows the proper setting for constant load engines

BRAKE H. P. AT BELT	NAT. GAS CU. FT. PER HOUR	BUTANE GALLONS PER HOUR	GASOLINE GALLONS PER HOUR	M. M. OIL DROPS PER MIN.	M. M. OIL HOURS PER QUART
10	115.	1.07	1.12	4	228
15	172.5	1.60	1.68	6	152
20	230.	2.14	2.24	8	114
25	287.5	2.67	2.80	10	91
30	345.	3.21	3.36	12	76
35	402.5	3.74	3.92	14	65
40	460.	4.28	4.48	16	57
45	517.5	4.81	5.04	18	50
50	575.	5.35	5.60	20	45
60	690.	6.42	6.72	24	38
70	805.	7.49	7.84	28	32
80	920.	8.56	8.96	32	28
90	1035.	9.63	10.08	36	25
100	1150.	10.70	11.20	40	22
120	1380.	12.84	13.44	48	19
140	1610.	14.98	15.68	56	17
160	1840.	*7.12	17.92	64	*4
180	2070.	19.26	20.16	72	12
200	2300.	21.40	22.40	80	11
225	2587.5	24.00	25.20	90	10
250	2875.	26.75	28.00	100	9
275	3162.5	29.42	31.10	110	8
300	3450.	32.10	33.60	120	7

EXAMPLE:—If you use 805 cu. ft. of dry gas, 7.49 gallons of butane or 7.84 gallons of gasoline, your H.P. is about 70, so adjust oiler to feed 28 drops per minute. You will then receive about 32 hours per quart of MARVEL MYSTERY OIL.

If engine load increases after setting for normal load, oiler will automatically increase its feed, or decrease its feed when load is lessened.

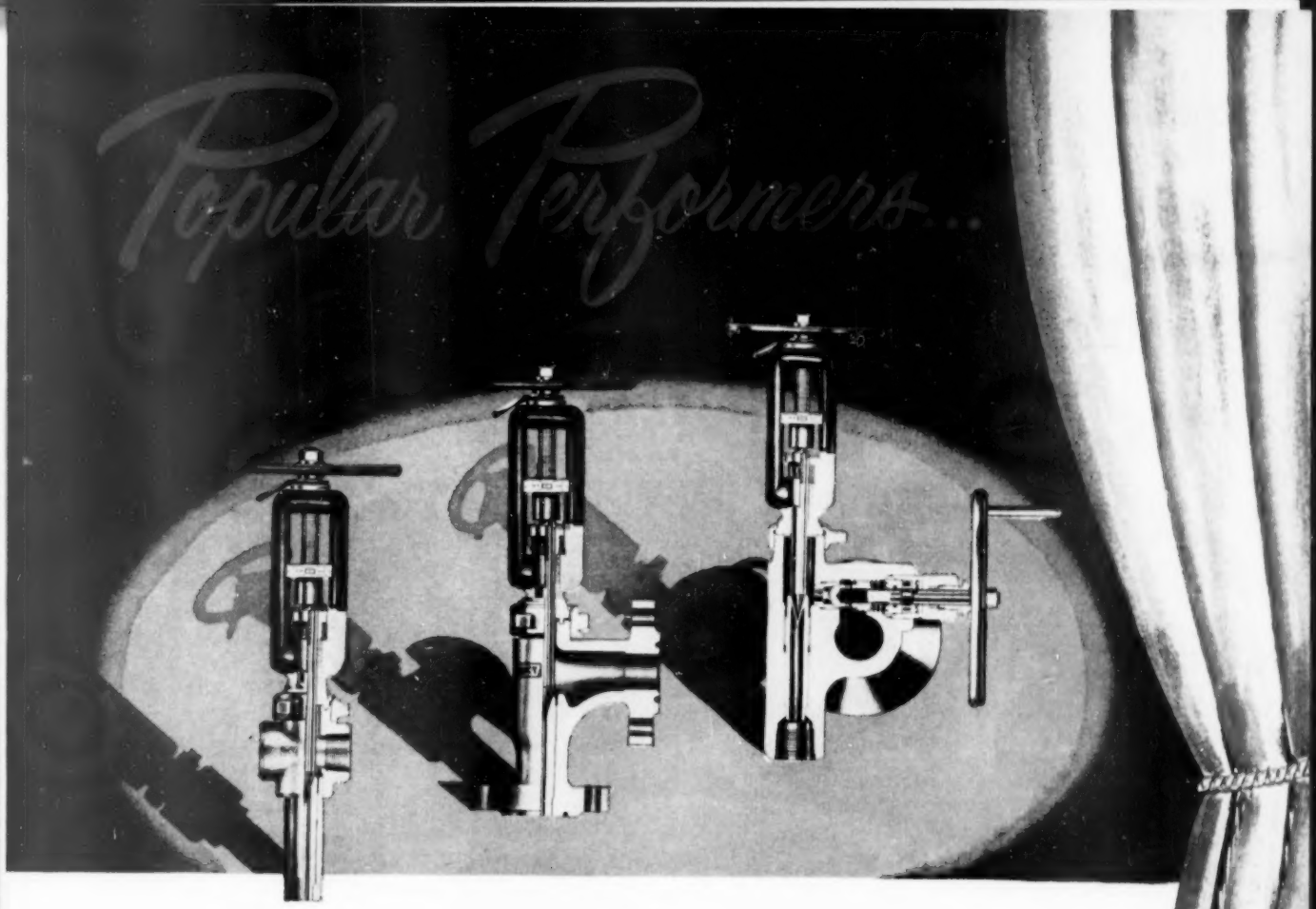
When more than one oiler is used

To determine drop count per oiler when more than one oiler is used on an engine—divide recommended drop count by number of oilers.

NOTE: Guarantee on oiler is void if any other oil than MARVEL MYSTERY OIL is used therein. Some *engines* also carry this guarantee policy.

See Your Local Jobber or Oil Well Supply House

EMEROL MFG. CO. Dept. 373, 242 West 69th Street, New York 23, N. Y.



. . . Because O-C-T Chokes are the most economical on the market

These O-C-T Chokes all have something in common that makes them the most unique and economical chokes on the market. It's this: the same yoke assembly and bean are used in each type.

This interchangeability of parts in O-C-T Chokes means that you need a smaller inventory investment to get the job done. As a result, O-C-T Chokes have become the most popular on the market and you can buy parts through more than 700 supply store outlets. Take full advantage of these savings O-C-T Chokes offer. Specify O-C-T Chokes to your supply store.

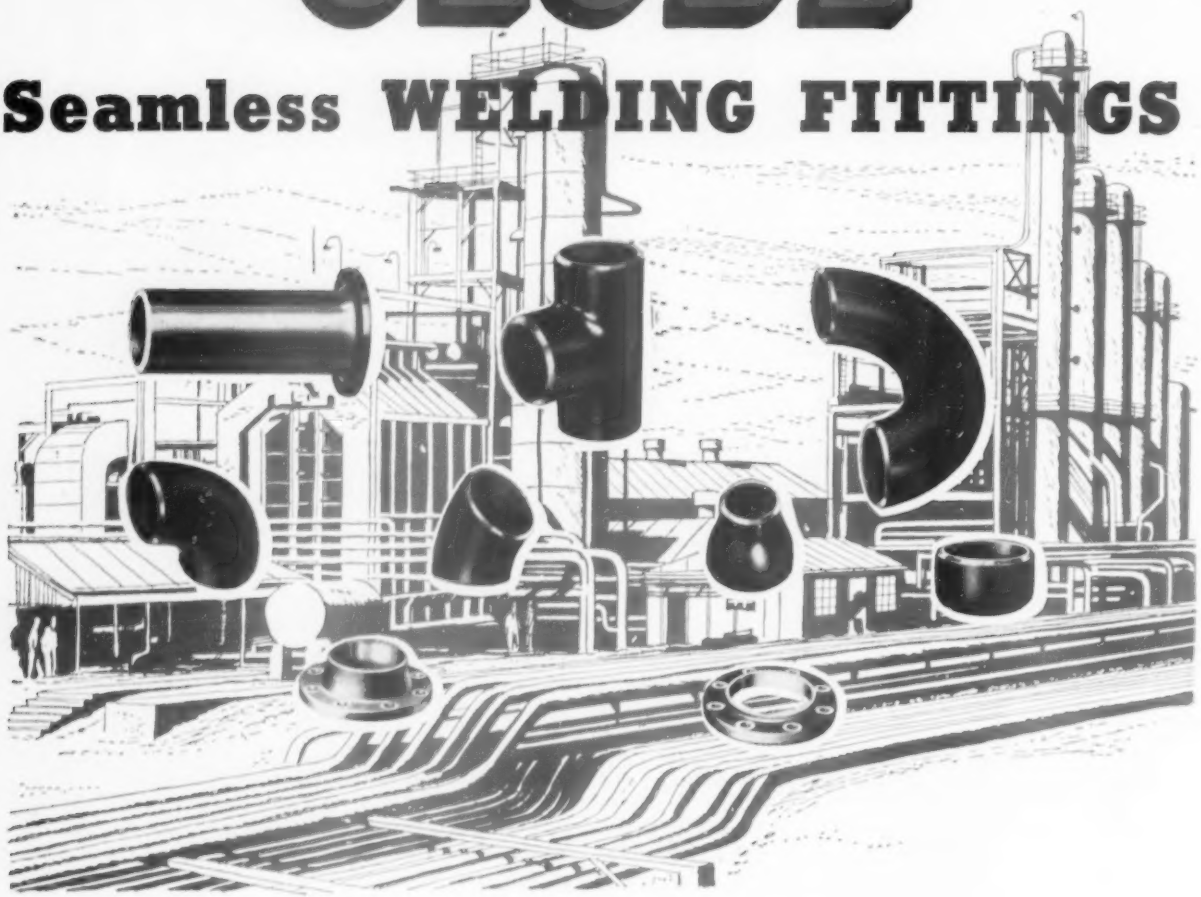
Most Supply Stores Carry O-C-T Chokes and Choke Parts [illegible]

Oil Center Tool Co.
P. O. Box 3091 Houston, Texas

Export Representatives Sterling Areas — Le Grand, Sutcliff & Gell, Ltd. Rochester, Kent, England Address Export Inquiries For All Other Countries to P. O. Box 3091, Houston 1, Texas

GLOBE

Seamless WELDING FITTINGS



The only seamless welding fittings
precision-processed... from billet... to tube... to fitting

From charging the specially designed revolving furnace with a steel billet (above) through the many succeeding steps of production, every Globe process is specialized to produce fittings of unvarying quality.

Globe precision-process manufacture begins with the billet —continues through the making of the seamless steel tube (Globe alone among welding fittings manufacturers produces seamless steel tubes)—and extends through to the production of the finished fittings.

Because Globe has highly specialized controls—at every stage of manufacture at its own plant—you can be sure of uniform high quality seamless welding fittings when you specify Globe.

Send for the Globe Welding Fittings complete catalog.

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Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis • Denver • Houston • San Francisco
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Producers of Globe Welding Fittings — Globe seamless stainless steel tubes — alloy-carbon seamless steel tubes — Gloweld welded stainless steel tubes — Globeiron (high purity ingot iron) seamless tubes.

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They Say—

Tideland's Controversy Costly

". . . Oil men operating on the Continental Shelf once again may have an opportunity to develop their leases—contracted in good faith—and to increase the flow of oil and gas into our economy from lands whose title contains no flaw.

"The title to offshore lands was never questioned—never became an issue—until oil was discovered on them. If it ever was necessary to establish their true ownership, there must have been a less costly way to do it."

Editorial in the Bulletin, published by Standard Oil Co. of California.

Iranian Oil Prospects Good

". . . In Iran, as far as oil production and distribution are concerned, the prospect—despite what may have been a premature announcement—now seems to be good. Premier Zahedi has been advised by a six-man committee to accept a consortium of American, British, and Iranian oil companies to market the country's oil.

"The prospective happy outcome is of considerably more importance to the peop'e of Iran than it is to the rest of the world, except as we all profit when any country is a little more prosperous and a little less exposed to Communist penetration. In 1950, the last full year before the Iranian oil industry was paralyzed, Iran's average output was about 6 per cent of the world's production. The world could and did get along quite well without Iranian oil. It can use it, however, and the people of Iran, if they have a chance, can use the proceeds."

Editorial in the New York Times

Danger in Price-Fixing

". . . This Supreme Court decision and the Phillips decision seem to move closer and closer to denying the right of the states to tax any natural resource.

"But the decision is a fact, and the thinking of state officials will have to be adjusted to it. Pipe-line gas undoubtedly will be the target for another attempt at taxation to provide funds for teachers' pay.

". . . Already there is talk of combining an increased production tax with the fixing of minimum prices for gas, so that the brunt of the levy would not fall upon the producers. Price-fixing by

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EVERY DEPARTMENT can use the Apeco Systematic Auto-Stat. This new all electric photocopying machine prints, processes and dries automatically. It's fast—dry copies in less than 45 seconds! It's convenient—fits on the corner of any desk . . . it's ready for instant use! It's easy—anyone can operate it! Saves up to 80% on copying jobs. Eliminates retyping, hand copying, checking or costly outside copying service. Makes legally accepted black and white or colored copies from any original up to 11" x 17"—printed on one or two sides. So low cost—a complete Apeco Systematic Auto-Stat installation is priced well within the budget of even the smallest firm.

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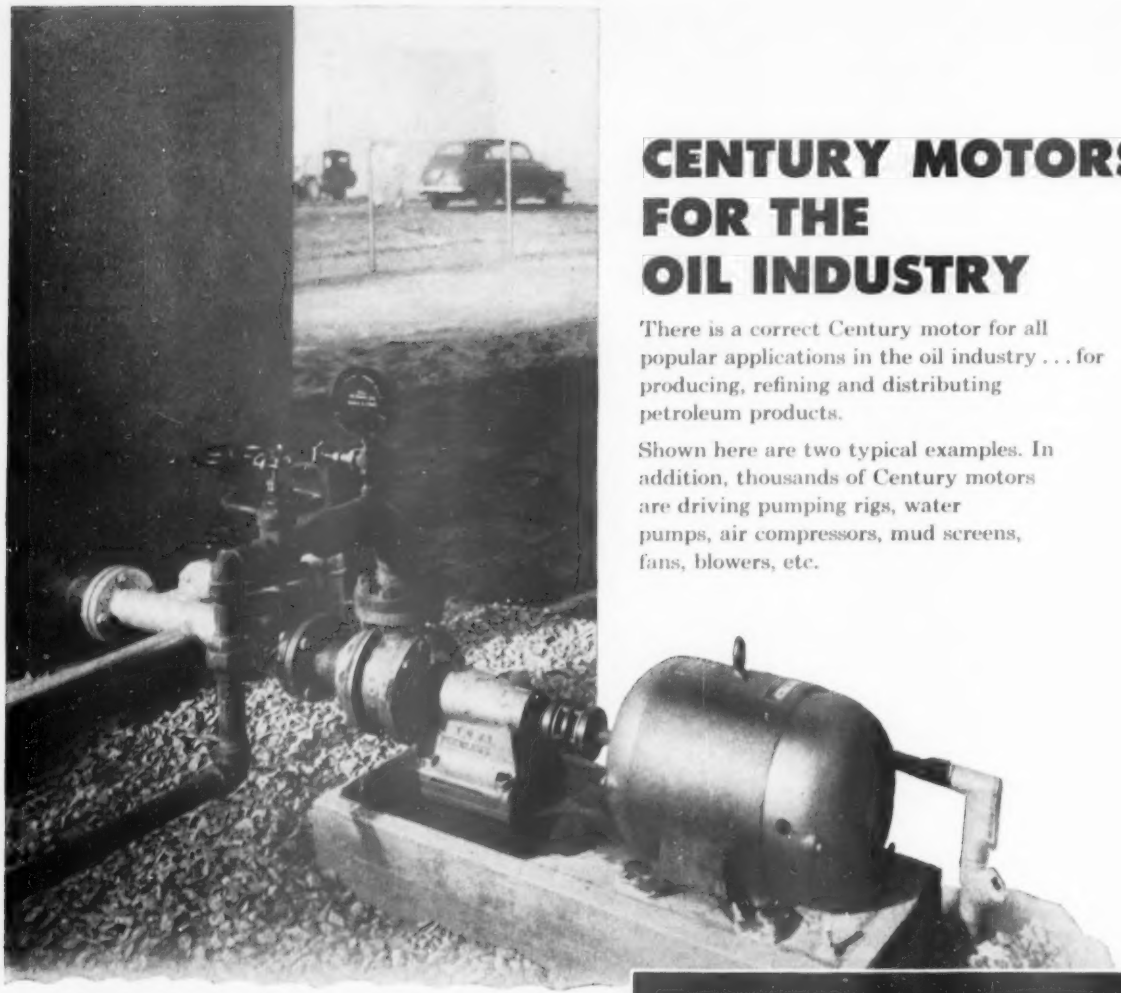


7½ horsepower Century explosion proof motor driving an oil pump.

CENTURY MOTORS FOR THE OIL INDUSTRY

There is a correct Century motor for all popular applications in the oil industry . . . for producing, refining and distributing petroleum products.

Shown here are two typical examples. In addition, thousands of Century motors are driving pumping rigs, water pumps, air compressors, mud screens, fans, blowers, etc.

Century

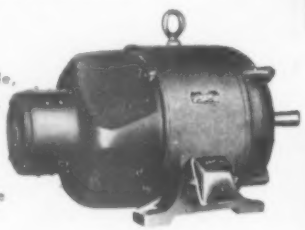
Splash Proof motors are scientifically designed to keep dripping and splashing liquids out of the vital parts of the motor. They assure dependable operation on outdoor installations, regardless of rain, snow, sleet or ice.

From Century's wide range of types and kinds of motors in sizes from ⅛ to 400 horsepower, you can select the ones best suited to your applications. Specify Century motors for all your electric power requirements.

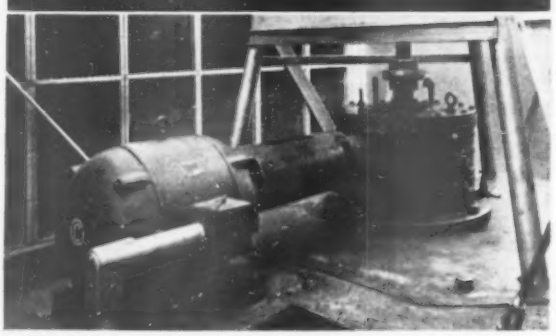
See your supply store for complete information.

CENTURY GENERATORS

Where public service current is not available, Century Generators will provide adequate, continuous electric power. Depending on the load per motor and the size of generator, from 10 to 30 wells can be operated from one generator. They provide a dependable source of oil field power.



ASSURE STEADY ECONOMICAL POWER



25 horsepower Century multi-speed splash proof motor driving a fan on a jacket water cooler in a refinery.

CE-775

CENTURY ELECTRIC COMPANY

government, whether state or federal, has been frowned upon as a restriction on free enterprise.

"One of its dangers is that price-fixing in one field invites price-fixing in other fields of business and industry. Such an innovation, insofar as Texas is concerned, demands careful study looking to its ultimate as well as its immediate effect."

Editorial in the Fort Worth Star-Telegram, Fort Worth, Tex.

Extent of Federal Power Disputed

"This issue turns broadly on the ancient dispute over how far the federal power of regulation extends to local activities—in this instance the local 'production and gathering' of natural gas that is sold to pipe-line companies for interstate transportation and distribution. There are hundreds of thousands of such local producers, ranging from very small to large, and it may be that a billion dollars or more is involved in this litigation."

Arthur Krock, New York Times columnist, in column on the Phillips case review.

Iranian Oil Problem Political

"The largest question which arises, assuming success of the negotiations, is how the resumption of Iranian production will affect other oil-producing nations, whose output has been stepped up to offset the closing of the Iranian fields and which will not willingly accept arbitrary curtailments.

"The likelihood, however, is that the rising world demand for oil will permit the gradual absorption of the additional Iranian output without causing serious dislocations. The best that Iran can expect, however, is that an honest effort be made to accommodate its interests. Iran's plight is the result of the obstinancy and fanaticism of the former government, and Iran has been the chief sufferer. Getting the country back in the oil business is more a political consideration than one of petroleum economics."

Editorial in the Fort Worth Star-Telegram.

CALENDAR

MARCH

4- 5 American Society for Testing Materials, spring meeting, Shoreham Hotel, Washington, D. C.

4- 5 American Petroleum Institute, Division of Production, Southwestern district, Rice Hotel, Houston.

4- 5 American Gas Association, transmission and storage conference, Jung Hotel, New Orleans.

Treat Your Tool Joints and Drill Collars to the FINEST Thread Protection

"Finest Thread Protection" means using either of these WECO Compounds. They both exceed the requirements for maximum thread protection . . . for minimizing galling . . . for sealing without freezing. WECO Compounds require no thinner, will not harden, are not affected by hot or cold weather.

Give your tool joints and drill collars the finest thread protection and they'll give you longer, better service.

NO-GALL 50% ZINC BASE

These who prefer a zinc base compound should specify NO-GALL. It contains more than 50% pure metallic zinc.

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If you want a lead base compound, specify LO-TORK. It contains 50% finely screened metallic lead.

WECO-API High-Pressure Thread Compound now available

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Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

RIG No. 6
Don't junk any old liners—
they're worth 35%
at Mission

HERE'S ALL YOU DO: When your mud pump reduced size liners (see note) become worn and need replacing, just turn them in to your supply store.

HERE'S WHAT YOU GET: Your supply store will deliver to you a guaranteed Mission RENEWED Liner with Satin Finish* at 35% less than new liner cost. Mission RENEWED Liners are reworked both inside and out to new liner specifications.

HERE'S WHAT IT COSTS: Your old liner is worth 35% of the cost of a new Mission Liner of the same size. Thus, you get a guaranteed RENEWED MISSION LINER with SATIN FINISH* for only 65% of the cost of a new liner.

NOTE: There are a few makes of liners of special material that are not suitable for renewing.

BRING YOUR OLD LINERS IN TODAY TO YOUR SUPPLY STORE AND GET MISSION RENEWED LINERS WITH SATIN FINISH*

Guarantee

Mission RENEWED Liners with Satin Finish* carry the same satisfactory service guarantee as new Mission Super-Service Liners.

* Trade Mark, Registered U. S. Patent Office.

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THE NEW WILLSON SAFETY HAT is entirely new in design, material and method of manufacture . . . tough as metal and more resilient! Here are some other outstanding features of the new Willson Super-Tough* Safety Hat . . .

streamlined contour—deflects objects more effectively and provides a greater safety "pocket" inside.

new suspension design—adjustable "hammock" headband is suspended *inside* at 6 points. No exposed rivets or lacing—no holes through hat.

comfortably cool—space between headband and shell provides ample air circulation for wearer.

five colors green, red, yellow, brown or white . . . to provide job or company identification.

Passes all required tests with an extra margin of safety!

Write for your copy of the new bulletin describing the Willson Super-Tough* Safety Hat.

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More than 300 Safety Products Carry This Famous Trademark

WILLSON®

Established 1870

WILLSON PRODUCTS, INC., 204 Washington Street, READING, PA.

8-10 American Institute of Chemical Engineers, Statler Hotel, Washington.

15-19 National Association of Corrosion Engineers, annual meeting, Municipal Auditorium, Kansas City, Mo.

17-19 American Petroleum Institute, Division of Production, Mid-Continent district, Biltmore Hotel, Oklahoma City.

23-April 1 American Chemical Society, annual meeting, Municipal Auditorium, Kansas City, Mo.

26 American Chemical Society and Sabine Area American Institute of Chemical Engineers, joint session, Beaumont, Tex.

29-31 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

APRIL

1- 6 Texas Independent Producers and Royalty Owners Association, Rice Hotel, Houston.

5- 7 American Society of Lubrication Engineers, Netherland-Plaza Hotel, Cincinnati.

6- 8 Petroleum Industry Electrical Association, annual convention and exhibit, Adolphus and Baker Hotels, Dallas.

8- 9 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Townsend Hotel, Casper, Wyo.

8- 9 Second annual instrumentation conference, Louisiana Polytechnic Institute, Ruston, La.

12-15 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, joint annual meeting, Kiel Auditorium, St. Louis.

13-15 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

14-16 National Petroleum Association, fifty-first semiannual meeting, Cleveland Hotel, Cleveland.

21-23 Natural Gasoline Association of America, thirty-third annual convention, Baker Hotel, Dallas.

22 Illinois Oil and Gas Association, annual membership meeting, Hotel Emmerson, Mount Vernon, Ill.

26-28 Southern Gas Association, annual convention, Houston.

MAY

2- 4 Independent Petroleum Association of America, midyear meeting, Cosmopolitan Hotel, Denver.

3- 5 American Geophysical Union, thirty-fifth annual meeting, National Academy of Sciences, Washington, D. C.

3- 5 Air Pollution Control Association, annual meeting, Patten Hotel, Chattanooga, Tenn.

6- 7 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Statler Hotel, Los Angeles.

9-12 Liquefied Petroleum Gas Association, annual convention and trade show, Conrad Hilton Hotel, Chicago.

10-12 Ninth annual Purdue Industrial Waste conference, Purdue Memorial Union, Lafayette, Ind.

10-12 American Petroleum Institute, Division of Transportation, Products Pipe Line Conference, Warwick Hotel, Philadelphia.

10-13 American Petroleum Institute, Division of Refining, midyear meeting, Rice Hotel, Houston.

14-15 Interstate Oil Compact Commission, General Oglethorpe Hotel, Savannah, Ga.

CHANGE SETTING IN SECONDS!

On The Versatile GUIBERSON TYPE A CONTROLLER

Type A Controller

- 2" Line Pipe Threads.
- Cast Steel Body.
- 3,000 psi Test Pressure.
- 1,500 psi Working Pressure.
- Stainless Steel Stem.
- "TEFLON" Stem Packing.
- "COLMONOY" Ball and Seat.
- Steel Drip Chamber with Monel Screen.
- Corrosion Resistant Materials in Controller Parts.
- Weather Proof Cover with Baked-on Enamel.

Adjustment for intermittent production at any given interval is just that quick on this Guiberson built unit. Lift the cover, shift the timing drum, set the adjusting screw at the point desired and the job is done. A series of fixed tabs on the revolving drum are spaced for different time cycles — five minutes, seven minutes, ten minutes, twelve minutes and other intervals that might be required. A broad range of injection frequencies is provided, from a minimum of five minutes to a maximum of one injection per revolution of the two-hour clock. Accurate timing of the injection period is obtained by a simple screw and each cycle repeats with extreme accuracy. There are no loose pins or tiny adjustment parts — no special tools are required.

Extremely versatile, the same unit is easily adapted to continuous or intermittent gas lift production, purging, down-stream or up-stream pressure control of tubing or casing, tubing control, casing control, or combination tubing and intermitter control. In any of these applications the controller has a very low "on-off" operating differential. Pressure adjustments may be made very accurately, conveniently; and the control is positive. The entire unit is built of corrosion-resistant materials; is compact yet accessible, light but strong, extremely sensitive though sure in operation.

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CORPORATION
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GREATER PROTECTION AGAINST FOREIGN MATTER—LONG

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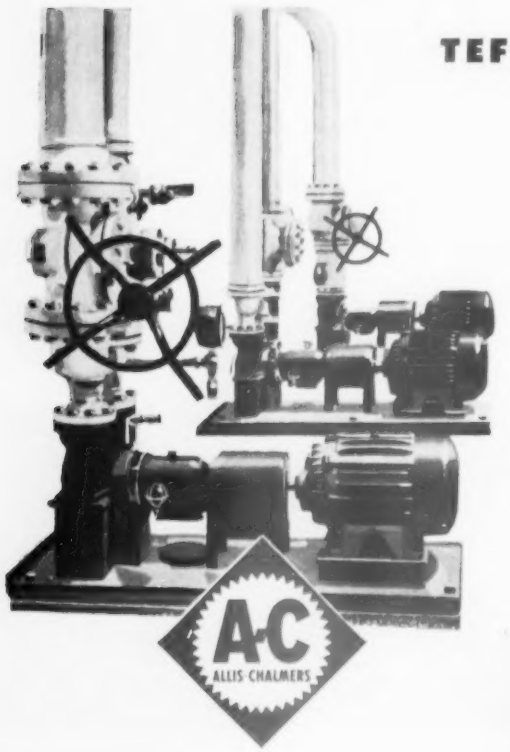
OPEN—DRIP-PROOF

Here are a few of the reasons why the new Allis-Chalmers open—drip-proof motor in NEMA rerate sizes will give you better performance and lower maintenance costs in general-purpose applications.

- Better protection against falling water and debris because cooling air inlets are on bottom.
- Long bearing life because large grease chambers provide plenty of reserve lubricant and are thoroughly sealed against foreign matter.
- Quieter operation, smoother performance.



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16-19 American Institute of Chemical Engineers, Springfield, Mass.
17-19 American Petroleum Institute, Division of Marketing, midyear meeting, Cosmopolitan Hotel, Denver.
24-26 American Gas Association, production and chemical conference, William Penn Hotel, Pittsburgh.
27-28 Natural Gas and Petroleum Association of Canada, Prince Albert Hotel, Windsor, Ont., Canada.
31-June 5 American Petroleum Institute, Division of Production, midyear committee conference, St. Francis Hotel, San Francisco.

JUNE

3- 4 Pennsylvania Grade Crude Oil Association, thirty-first annual meeting, Hotel William Penn, Pittsburgh.
6-11 Society of Automotive Engineers, summer meeting, Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J.
13-18 American Society for Testing Materials, annual meeting and exhibit, Sherman and Morrison Hotels, Chicago.
17-19 American Petroleum Institute, Division of Production, eastern district meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.
20-24 Canadian Gas Association, Banff Springs Hotel, Banff, Alta., Canada.
27-July 1 Petroleum Equipment Suppliers Association, nineteenth annual meeting, Manoir Richelieu, Murray Bay, Que., Canada.

AUGUST

17-19 Society of Automotive Engineers, Inc., international West Coast meeting, Georgia Hotel, Vancouver, B. C., Canada.

SEPTEMBER

9-11 Interstate Oil Compact Commission, Omaha, Neb.
12-16 American Institute of Chemical Engineers, Colorado Hotel, Glenwood Springs, Colo.
15-17 National Petroleum Association, fifty-second annual meeting, Traymore Hotel, Atlantic City, N. J.

OCTOBER

4-6 Texas Mid-Continent Oil and Gas Association, annual meeting, Plaza Hotel, San Antonio, Tex.
7- 8 California Natural Gasoline Association, twenty-ninth annual fall meeting, Ambassador Hotel, Los Angeles.
11-13 American Gas Association, annual convention, Atlantic City, N. J.
11-13 American Association of Oilwell Drilling Contractors, annual meeting, Biltmore Hotel, Los Angeles.
12-15 Eighth National Chemical Exposition, Chicago Coliseum, Chicago.
14-17 Permian Basin Oil Show, Odessa, Tex.
24-26 Independent Petroleum Association of America, annual membership meeting, Mayo Hotel, Tulsa.
26-27 Society of Automotive Engineers, national diesel engine meeting, Statler Hotel, Cleveland.

NOVEMBER

4-5 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.
8-11 American Petroleum Institute, thirty-fourth annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.
28-Dec. 3 American Society of Mechanical Engineers, Statler Hotel, New York.

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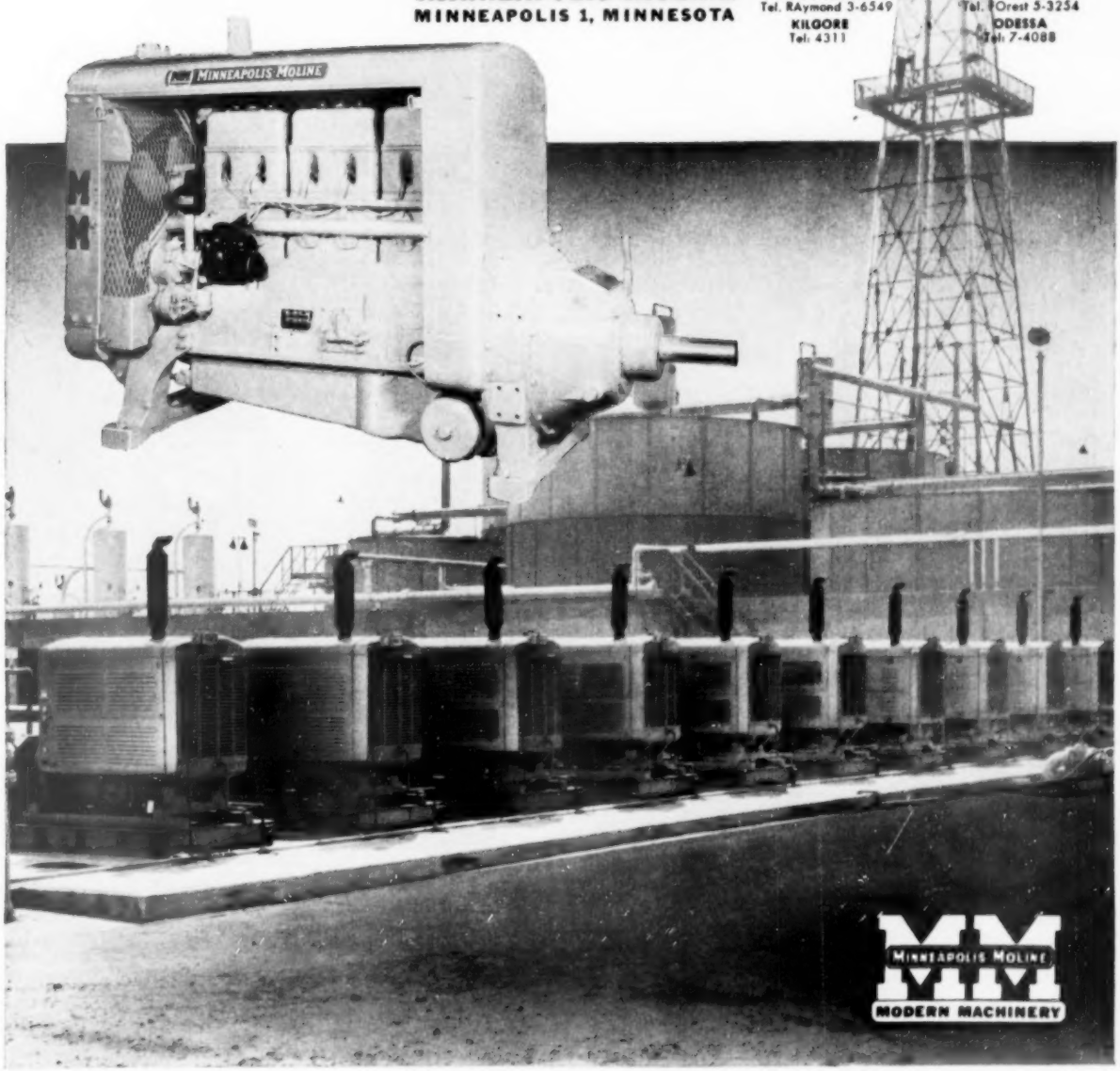

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THE OIL AND GAS

JOURNAL

TULSA, OKLAHOMA

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JOURNALLY Speaking

Fog Factor

A NUMBER of readers apparently got a chuckle out of our recent ribbing of the pedantic esoterism of a press release of the Mid-Century Conference on Resources for the Future, Inc., which expatiated in sesquipedalian circumlocuity and polysyllabic prolixity regarding the essential dynamism of the techno-economic basis of industrial expansion.

One cited this "fog factor formula" devised by Robert Gunning, a writing consultant:

$$\text{Fog factor} = 0.4\left[\frac{\text{No. of words}}{\text{No. of sentences}} + \frac{\text{No. of 3-syllable or more words} \times 100}{\text{No. of words}}\right]$$

Applying this formula, he reported that the parts of that press release we quoted had a fog factor of 26, compared with fog factors of 6 to 10 for popular writing and 10 to 17 for most technical publications.

That's getting a bit deep for us. We have seen plenty of foggy writing, but we eschewed mathematical evaluation of the density of the obfuscation—er, we mean we never tried to measure it. They didn't teach mathematical formulas when we studied writing. They just told us that the best way to convey an idea was to use short sentences, simple words, and expressions that everybody could understand.

We'd be afraid to apply this fog formula to our own stuff, though, even if we knew how to work it. We just play by ear. But we're glad to learn that engineering principles have been applied to writing. Maybe this will help engineers to improve their writing, some of which often seems almost as foggy as the fancy effusions of the economists.

Wagon Wheels

YOUNGSTERS are advised to skip this item. It's a nostalgic note from the horse-and-buggy age, utterly meaningless to anyone who can't tell a hame from a trace.

Standard Oil Co. (Ohio) has discontinued the sale of Mica Axle Grease and Eureka Harness Oil. Those were among the first and principal products of what was then the one and only Standard Oil, back around the turn of the century when gasoline was poured on the creeks to get rid of it. Both were familiar sights on every farm, and the galvanized grease pail found many subsequent uses after the last bit of goo had been frugally scraped out.

There were no lubritoriums in those days, and greasing the wagon was a regular, though not onerous, chore. There were such things as wagon jacks, but few farmers boasted such a luxury except those that were fashioned from 2 by 4's right on the place. The usual method was to put a long pole under the axle, wedge a stick of cordwood under the pole for a fulcrum, and put a boy on the end of the pole to raise the weight off the wheel. Then father would unscrew the nut with the wagon hammer slipped out of the doubletree clevis, slide off the wheel, and apply gobs of the dark green Mica grease to the bare axle with a piece of shingle. Care had to be taken not to let too much dirt or sand get onto the axle while the wheel was off.

A strong man, experienced at the trick, could grease a wagon without a jack. A pull just hard enough but not too hard would slide the hub out far enough to expose the axle. Then, steadily bracing the felloes with his chest, he could reach between the spokes and apply the grease. But this was no job for a boy. Too hard a jerk, or careless relaxation of pressure, would let the wheel slide out so far that it couldn't be pushed back, or perhaps even drop the axle to the ground—an ignominious disaster that could be repaired only by calling for father and the hired man to come with a pole.

Mica Axle Grease. It's been a long time.

—*Henry D. Ralph.*

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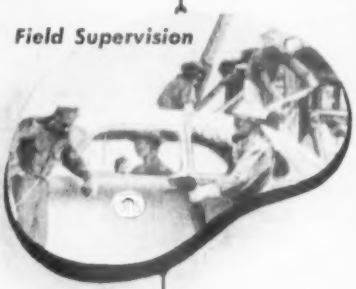
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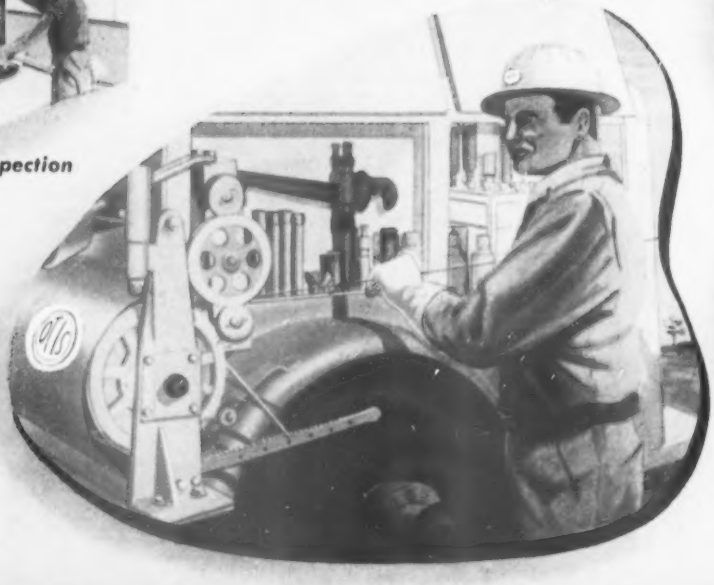


Coverage

Why one big oil union?

A MOVE is afoot to amalgamate a score or two of independent unions in the petroleum industry into one big union to include all employes of the industry and conduct collective bargaining on an industry-wide basis.

The reason given for this is that big oil companies do business on a nation-wide scale, so their employes should be in position to bargain on a nation-wide scale.

This seems a rather superficial reason. The companies have never got together on an industry-wide labor contract, and not more than one or two have completely uniform wage and other provisions throughout their individual operations.

BUT this lack of uniformity is not iniquitous or unwarrantable. There are not serious disparities among companies, plants, and localities. Those that exist reflect a recognition of such factors as the competitive positions of the companies, operating costs at certain plants, and regional and local living costs and prevailing wage rates.

Wages throughout most of the oil industry are just about the highest of any in the nation. A possible exception is the marketing branch, where most of the workers are employes of independent retailers rather than the big oil companies. Hours, safety, pensions, housing, and other working conditions and benefits are also ahead of most of American industry. Throughout its history the oil industry has been singularly free of serious labor disturbances or grievances.

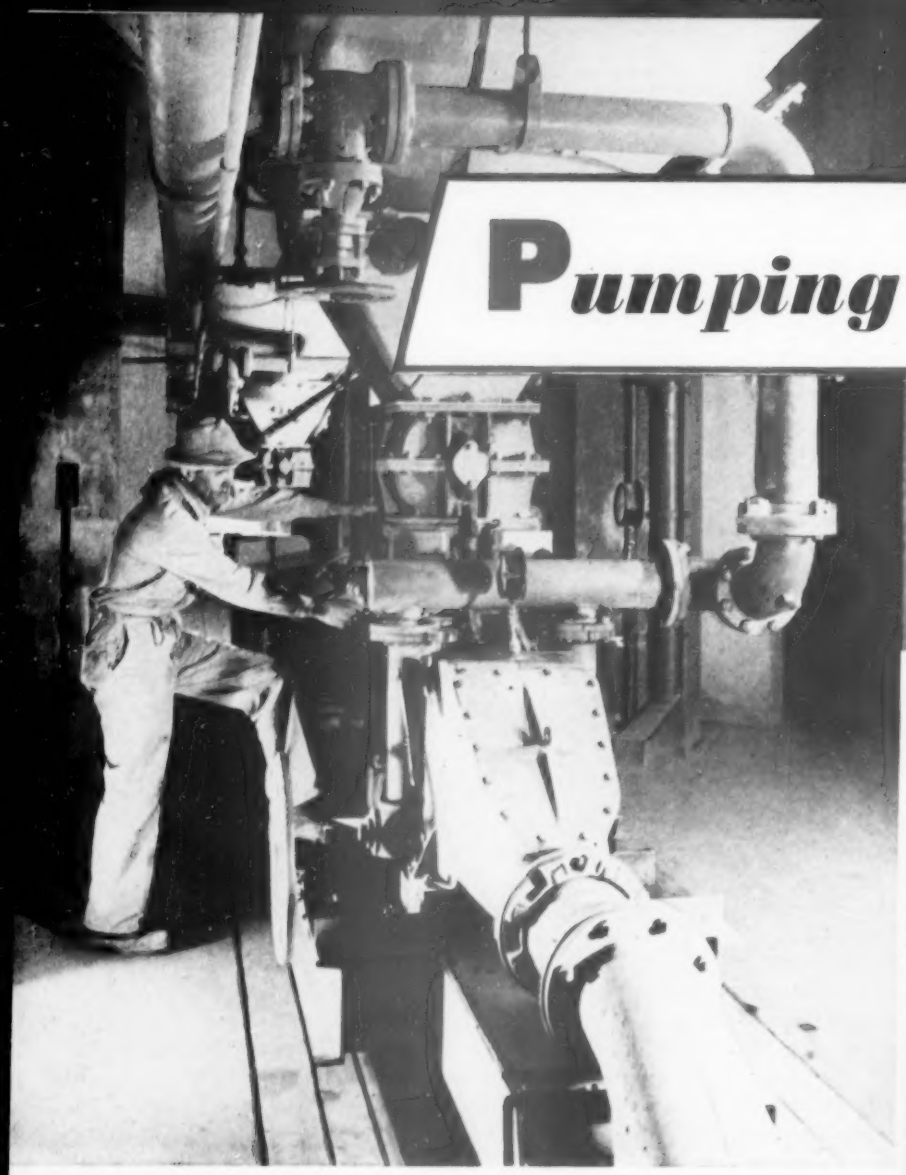
This enviable position has been achieved, for the most part, through collective bargaining on the local level with independent unions representing the workers of a single installation. The competitive forces operating in this plant-by-plant bargaining, without collusion among companies or unions, has raised the general level of working standards while protecting special local conditions.

Furthermore, the present system has protected the public from the disaster of a nation-wide shutdown of the entire oil industry, such as has occurred in industries with a single big union.

WHAT would be gained by changing the system now? Independent unions would lose their autonomy—and also their chance to negotiate a better deal than the national average. By working independently, many locals have obtained more benefits than the national unions have.

The only gainer, so far as we can see, would be the Oil Workers International Union (CIO). By far the largest and best organized of the 70 or more unions in the industry, the OWIU could hope to dominate the amalgamation and, sooner or later, absorb all oil workers into its dues-paying ranks. The chief motivation and result of the merger attempt would seem to be the aggrandizement of this one group.

Pumping Cement



● At the plant, Lone Star Cements are pumped to packing machines or bulk-cement cars direct from huge storage silos—separate silos being used for each cement. So, when you pump cement at the well—whether the hole is deep or shallow, whether there's a sulphate-water condition, and whether it is securing a casing, a squeeze job, plug back, restoring lost circulation or any other purpose—the Oil Man can be *sure* he is getting the cement he needs for the particular job.

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THIS WEEK... ...IN THE NEWS

TECHNICAL MISSION of 20 representatives of 8 international oil companies is shown here with Iranian officials as it toured the Abadan refinery in Iran to determine just what investment will be needed to resume operation. The team returned to London after an inspection of the refinery and other nationalized properties of Anglo-Iranian Oil Co., Ltd., in Iran. Detailed conclusions of the group have not yet been formulated, but individual members of the group called the survey "most worthwhile."

INTERNATIONAL—Saudi Arabia suspends for 6 months its order prohibiting Pacific Western from moving its Neutral Zone production through American Independent's pipe line into Kuwait for tanker loading. . . . ¶Socony-Vacuum and Anglo-Egyptian reach agreement with Egypt covering resumption of exploratory operations. . . . ¶Cost of South African coal-to-oil plant now set at $89,000,000. . . . Increase blamed on higher equipment costs, expansion of capacity. . . .

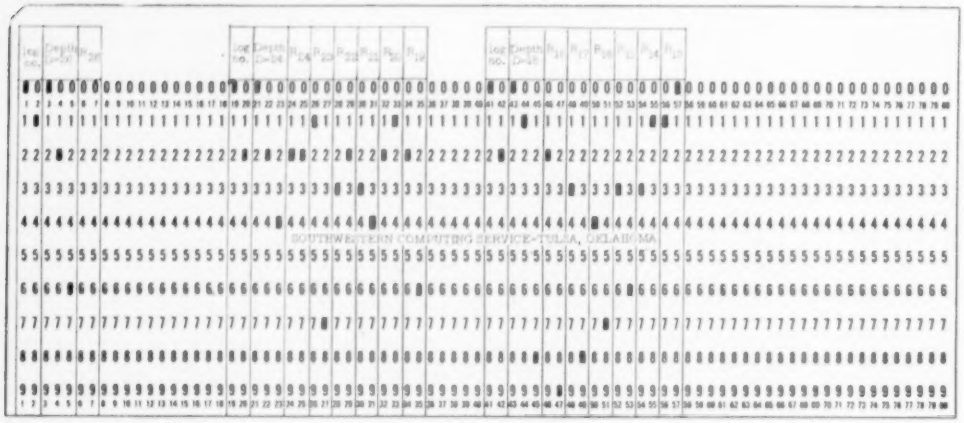
GOVERNMENT—Justice Department reveals second series of indictments involving fraudulent purchases of U. S.-owned surplus tankers. . . . Included in latest list of those charged is Stavros Niarchos, owner of world's largest tanker who last week revealed orders for two more even larger crude carriers have been placed with British shipyard. . . . ¶Texas asks Supreme Court for a rehearing of the gas-gathering tax case. . . . ¶Supreme Court will hear renewed arguments April 5 in Phillips case regarding FPC jurisdiction over gas producers and gatherers. . . .

EXPLORATION—Shell continues testing its indicated Nevada discovery, which may bring the number of producing states to 29. . . . Oil recovery on test indicates a daily output of 180 bbl. . . . Well is halfway between Utah and California production. . . . ¶North Dakota modifies its proration rules to provide higher allowables for the first four wells drilled in any field. . . . Discovery allowables set at 200 bbl. daily for 18 months or until fifth well is completed. . . . Action follows complaints that low allowables were discouraging exploration. . . . ¶Arkansas Fuel Oil wildcat discovers what appears to be new gas-condensate field near Houma, La. . . .

REFINING—Salt Lake Chemical Co. announces the latest project in the nation's $170,000,000 ammonia building program. . . . New plant will be designed to produce 120 tons daily of ammonia and 30 tons of dry ice. . . . ¶Socony-Vacuum unveils its new catalytic reforming process, which it calls "Sovaforming." . . . The process employs a platinum catalyst and operates on a fixed-bed principle. . . . ¶Independent Refiners Association objects to plan for return of Iran's oil to world market. . . . Members protest "selected few" large organizations will handle production. . . .

TRENDS—Crude from the Middle East accounted for 34.3 per cent of crude imports by the United States in 1953 compared with 27.6 per cent in 1952. . . . Venezuelan crude made up 50.0 per cent of total crude imports in 1953, down from 57.5 per cent of the total in 1952. . . . Residual imports, mostly from Venezuelan crude, increased 19,600 bbl. daily in 1953. . . .

ACTIVITY—Production of crude and lease condensate averaged 6,320,375 bbl. daily for week ended February 20, down 16,300 bbl. daily. . . . ¶Total well completions for the week decreased 127 wells to 912. . . . Wildcat completions totaled 174 wells compared with 215 for previous week and with 197 for same week last year. . . . ¶Rotary rigs operating in the United States decreased 33 rigs in week ended February 22 to 2,518. . . .



REPRESENTATIVE PUNCH CARD containing electric-log correlation data.

TAPE from tabulating machine.

Punch Cards Match Electric Logs

Business machines enter a new petroleum field, provide high-speed, accurate correlation of geological information

Kenneth B. Barnes

TULSA.—Electric logs can now be correlated with a precision vastly surpassing that of visual observation, thanks to a new geologic development utilizing business-machine "punch cards" and the new high-speed electronic calculators.

The new method has been developed by Dr. Charles W. Oliphant, an independent geologist, and Paul Fullerton of Southwestern Computing Service, Tulsa. Machine correlations have been made and tested for wells located in eastern Osage County and Noble County, Oklahoma, and in Daniels County, Montana.

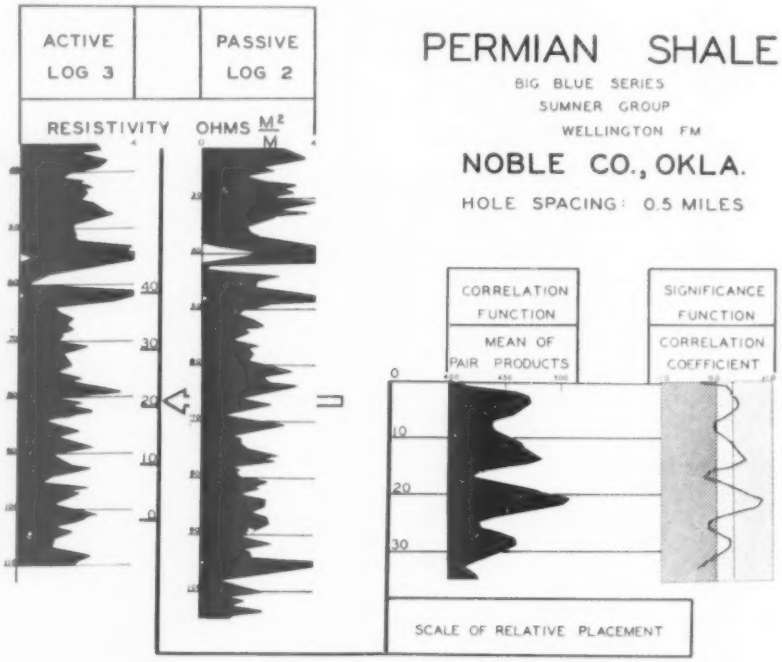
The machine correlator in its precision analyses can line up formational sequences as present in two wells to a far better fit than can be done by merely sliding the logs up and down alongside one another.

In the latter, a "fit" is easy enough where all the formational sequences are the same, and the thicknesses are the same. However, in prospective oil territory where considerable lithological variations are common, the new method is particularly appealing. The method eliminates "sticking out your neck," where correlations are unsure.

The correlation problem . . . Oliphant summarizes his development this way: "The method involves correlating stratigraphic sections by computations on a punch-card calculating machine. The main interest is in matching two sets of observations, specifying a degree of confidence in the match, and interpreting the continuity of the matched rock units."

As to purpose and origin of his study, Oliphant says: "When stratal sequences do not match, it becomes increasingly difficult to interpret the continuity of rock units. For each geologist there is an inherent threshold of confidence which must be equaled or exceeded before he will state that a correlation exists. In the method, we are not interested in the easily matched and obviously correlative sections, but rather with the variable strata that fail to meet the correlation standards of most geologists.

"Our purpose is to study these highly



ELECTRIC LOG and correlation data of wells in Noble County, Oklahoma.

variable strata with controlled objectivity and achieve the best correlation possible under difficult circumstances.

"The problem is general for all continental and some deltaic sediments; it was first presented to me by surface mapping difficulties in the Williston basin. Starting in 1952, I mapped surface structure of the Fort Union and Lance formations in eastern Montana from outcrops, core holes, and core holes with electric logs. The structural results were only as good as the correlations and in many areas these were poor, far below my personal threshold of confidence. The computational studies were started in an attempt to reclaim some of the dollars and hours expended."

How it works . . . In correlating the electric logs of two wells, a standard log, which is used as the correlating yardstick, is designated as the passive log.

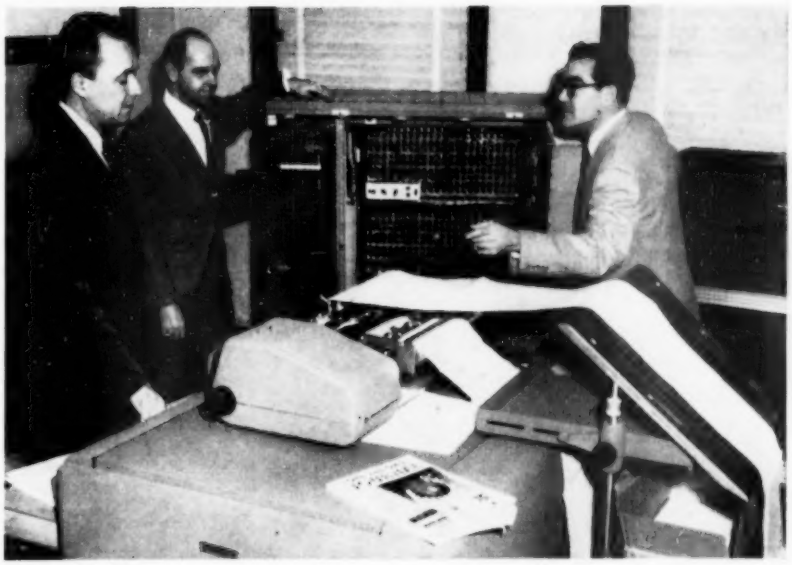
Only the resistivity side of the electric log is used, for example the short normal curve. Suppose the formation interval from 4,550 to 4,575 ft. is under examination. The apparent resistivity value for each foot of depth interval between 4,550-4,575 ft. is "key punched" into the IBM card. Next the resistivity values for the other or "active" log also are key punched into IBM card.

Punched cards were used for the numerical work since they provided a means of performing at high speed the association of the depths and resistivities and the large amount of arithmetic involved. The first computation on the calculator produces a correlation function, the "mean pair product" of resistivity values as the active log slides past the passive log.

The best correlation between the passive log and the active log is obtained where the correlation function reaches a maximum. In the accompanying drawing, the maximum mean pair product is obtained at relative placement position 23; besides the maximum, there also are minor peaks at 4, 14, and 29, due partly to the cyclic nature of the sediments.

To judge the significance of each peak, the correlation coefficient is calculated at each position of relative placement for the two logs; this produces a significant function whose values vary between —1.0, 0.0, and +1.0. When this value of the correlation coefficient is in the —1.0 to 0.0 range, the correlation is poor or dangerously uncertain. The higher the correlation coefficient goes in the range between 0.0 and +1.0, the more trustworthy and significant is the match.

In the illustration based on logs from Noble County, Oklahoma, likewise will be noted four peaks in the significance function; however, the most significant peak is at position 21. In the illustration, the passive log and the active log have been set up to correlate at this optium placement position 21, and it is mathematically by far the most precise formational correlation possible for these two electric logs.



IBM MACHINES used in correlating logs. Left to right are Thomas J. Bevan, geophysicist with Southwestern Computing Service; Dr. C. W. Oliphant, and Paul W. Fullerton.

Future . . . Tulsa area geologists and electric log experts who have carefully studied the machine correlator technique agree that the correlation functions and significance functions have a useful application to detailed stratigraphic correlations of qualitative and quantitative data.

However, Oliphant cautions that parts of the method should receive additional study and in some cases may necessitate modifications, and he adds: "In particular we are aware that stratigraphic data are not a sequence of statistically independent observations; nor are the values of the calculated correlation coefficient.

"We are also sensitive to the fact that stratigraphic data do not generally constitute a stationary series whose statistical parameters are independent of the origin of the series. The method, itself, should receive further study and be modified as necessary. But the utility of the method will undoubtedly remain."

The types of formational deposits that are believed most suited for detailed machine correlations are those which are not readily accomplished by a geologist. Heterogeneous sediments whose gross lithologic character is constant but whose detailed depositional sequence varies greatly in small vertical and horizontal distances are generally best for machine correlation studies. Tertiary rocks of the Gulf Coast, California, and Rocky Mountain areas offer numerous examples; the Cretaceous, Pierre shale should be particularly suitable. Special reservoir studies may be possible in Pennsylvanian conglomerates and granite washes as found in the Elk City field of Oklahoma.

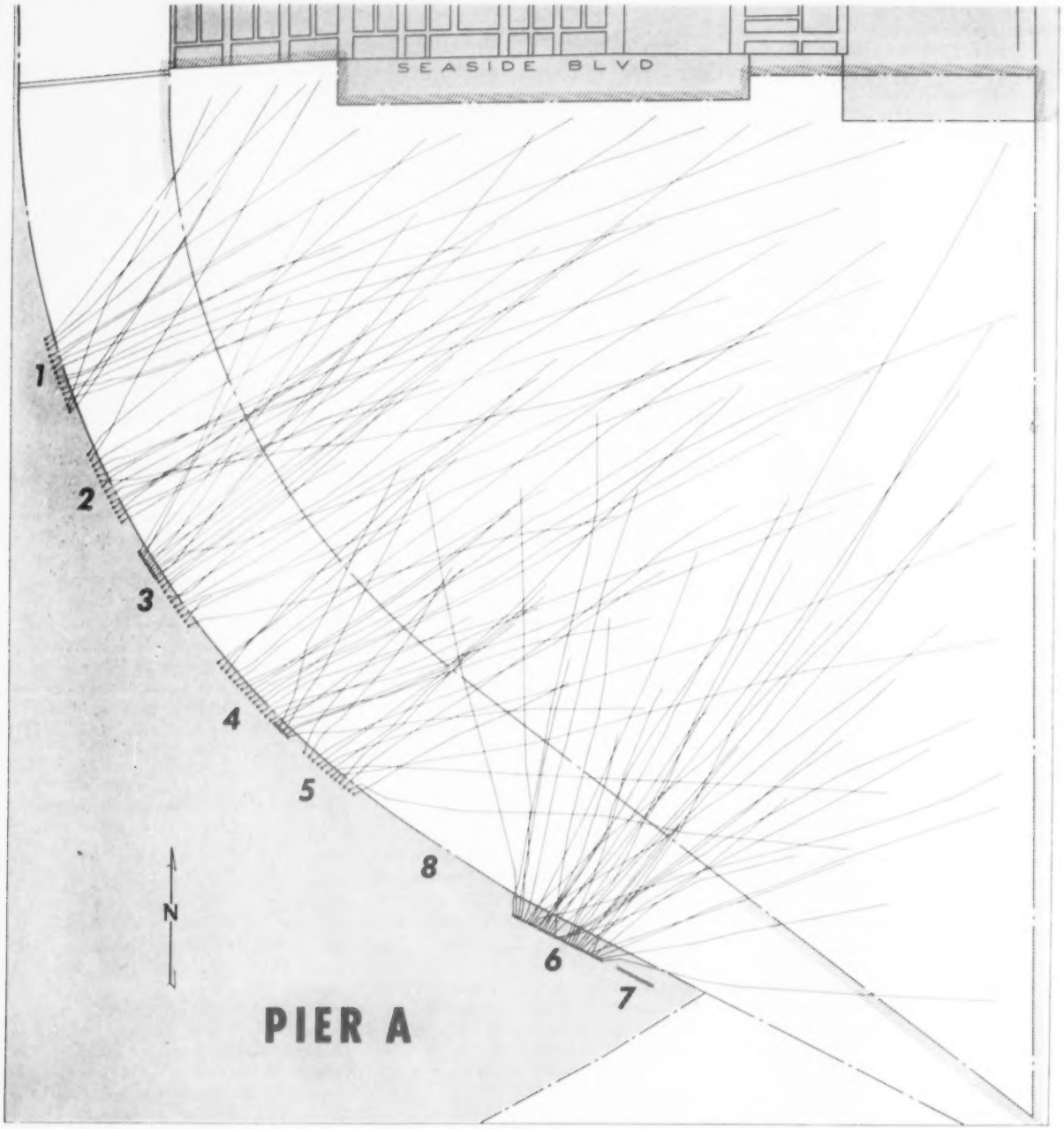
Radioactive Pig Tests Line

SUPERIOR, Wis. — Engineers of Tracerlab, Inc., Boston, carried out what is probably the largest, longest, and toughest radioactive "tracer" project ever attempted in the testing of the 30-in., 652-mile Lakehead Pipe Line Co. crude line from here to Sarnia, Ont.

For 3 months, the engineers tracked a radioactive "pig" through the Lakehead line with a Geiger counter. The pig traveled through the line at the rate of about a mile per hour, with the manner of its travel serving as an indication of leaks or obstructions.

Sonar-type instruments are generally used to track the pig by picking up sound waves produced by the pig as it moves through the pipe.

To aid sonar detection methods, a radioactive source was added to the pig and engineers were able to track it through 5 ft. of earth with a portable Geiger counter. Radioactivity - detection methods were utilized each time the sonar method was incapable of establishing positive location of the pig being tracked.



Drill Bits Thread Harbor Field

D. H. Stormont

LONG BEACH.—Future drilling on Richfield Oil Corp.'s Long Beach Harbor lease is going to be very much like threading a needle with a drill bit.

Richfield's slant-hole drilling from Pier A requires exceptionally close directional control if it is to maintain pin-point accuracy necessary in the operation. Each new well from the pier literally threads its way laterally through the already developed portions of Wilmington field.

No new well has yet intersected a producing well, but a glance at the accompanying map shows readily that there is a fair chance this might happen if the drilling course is not carefully planned and closely controlled.

Parcel A, a 250-acre submerged lease, begins some 600 ft. east of Pier A and extends eastward to Rainbow Pier. Richfield started drilling the parcel in 1947, when it was granted a de-

velopment contract by the City of Long Beach and the Board of Harbor Commissioners. This contract, incidently, involves a royalty payment of about 94 per cent, out of which normal operating costs are taken.

Since then, 118 wells have been completed. Of these approximately 70 are in the upper and lower Terminal and 36 are in the Ranger zone. The remainder are Tar, Union Pacific, and Ford zone producers. Their combined daily production is about 12,000 bbl. at the time.

All wells are slant-holes drilled from sites along the eastern edge of Pier A. Some were deviated horizontally only a few hundred feet, but in others the drift angle exceeds 67°. One Ranger well has a drilled depth of 5,150 ft., a vertical depth of 2,950 ft., and a deviation of 3,850 ft.

The operation, since the beginning, has been conplicated by lack of drill sites. For this reason, Richfield now finds it necessary to work new wells through the already drilled portions. Another cause is that some of the zones being produced were not believed to be productive or their area would not be as extensive as the drill has proved it to be. Still other wells could be classed as in-fill wells, being drilled now that additional sites are available.

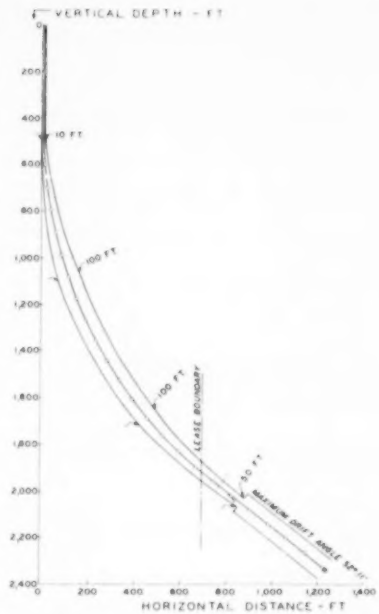
When Richfield started development drill sites available were those numbered 1 to 5 on the map. All wells had to be confined to the spaces shown. The open area between well batteries are used for sports fishing.

During this early period offset requirements first were met and the area then developed as extensively as the limited surface locations permitted. The southeast site, No. 6, did not become available until 1950, following the pier's expansion.

Currently some in-fill drilling is being carried on from the older drill sites, where a surface well spacing of 25 ft. was originally used. Because all wellhead controls are placed underground it is possible to interspace new wells between the older ones. Most of the approximately 45 wells needed to complete development will be from the new drill sites, Nos. 7 and 8.

To assure that any new well will not intersect a completed producer, section and plan plots are prepared of the planned well and those already drilled. Effort is made to use a well site, deviation point, and rate of angle buildup which will result in the planned well clearing other wells by at least 100 ft. Each is planned with the idea a constant direction will be maintained once it is deviated from vertical.

Also before a well is started its planned course is plotted in vertical



TYPICAL VERTICAL plan for a Richfield slant-hole well includes close lateral control of the hole as well as vertical deviation.

and plan views such as shown in the accompanying chart. Boundaries within which the hole must be kept to avoid drilling into another well, or to assure a mechanically correct hole, also are added as shown. Progress of the well as it is drilled, as revealed by single-shot surveys, then is plotted on the section and plan diagrams.

Depth at which a hole is deviated from vertical, or "kicked-off," depends upon the depth of the objective zone and distance of the target from the drill site. Kick-off point may be at a depth of 1,800 ft., or it may be at 150 ft. and before the usual 350-ft. section of surface pipe is set.

As soon as the slant hole is started, drift angle is built up at the rate of 3-4° per 100 ft. until the desired maximum drift is attained. This angle then generally is maintained to bottom.

In drilling to the kick-off point, the well generally is kept within a 10-ft. diameter cylinder. Hole then is confined inside a cylinder having a 100-ft. diameter until top of the producing zone is neared. At this point a 50-ft. diameter cylinder is imposed, with the idea that any hole passing through this bottleneck will automatically bottom within a 100-ft. diameter target. Drilling through the pay zone thus can be carried out as quickly as possible.

Exploratory Firm Formed

LOS ANGELES.—Oceanic Exploration Co., a limited partnership with a capitalization of $2,000,000 has been formed here by Oceanic Oil Co., J. Barth & Co., and A. C. Allyn & Co. to test about 40 geological prospects in California and Texas.

Fred M. Keller, Oceanic Oil president, said the new exploration concern has raised $3,700,000 in outside capital to be spent over a 2-year period.

Oceanic Oil will furnish the geology, land, and administrative services and Oceanic Exploration will drill wildcat wells on the prospects with the two sharing equally in any successful ventures.

1,000th Well Completed

BAKERSFIELD, Calif.—The 1,000th well in Naval Petroleum Reserve No. 1 at Elk Hills has been completed by the unit operator, Standard Oil Co. of California.

Only 368 of the field's 1,000 wells are open to production due to the regulations requiring maintenance of the field as a reserve for use only in time of extreme national emergency.

The field is calculated to be potentially capable of producing upwards of 130,000 bbl. of oil daily, about one-tenth the current combined daily production of oil from all other fields in California.

Current production from the Elk Hills field averages 23,000 bbl. per day. Of that production, about 1,000 bbl. daily is from the Stevens zone and the remainder from shallow sands.

Five contract rigs are still active at Elk Hills—two developing the Stevens zone, two in shallow sand development, and one drilling an extension test to the Carneros sand. Drilling will probably be curtailed at the reserve in the near future.

Under the unit contract for the field, the Navy gets a major share of the oil which is sold under competitive bid with Wilshire Oil Co. currently buying the oil. Standard Oil Co. of California gets the remainder of the production.

CANADA

Vote Set on Kenwell Sale

TORONTO, Ont.—Stockholders of Kenwell Oils & Mines, Ltd., Toronto, will vote March 3 at a special meeting here on the proposed acquisition of the company by Sapphire Petroleums, Ltd., Toronto.

Under the proposal Kenwell stockholders would receive one share of Sapphire stock for each share of Kenwell stock. Sapphire was recently authorized to increase its capitalization from 3,500,000 to 7,500,000 shares,

with 2,025,266 of the additional shares effecting the acquisition of Kenwell. The shares have a part value of $1.

After buying Kenwell, the firm's recoverable oil reserves, exclusive of secondary reserves, would be increased from about 5,500,000 bbl. to nearly 8,368,000 bbl. Sapphire's interest in a 350,000-acre tract covering part of the Athabaska oil sands of northeastern Alberta also would be increased from 10 to 13¾ per cent.

Test Completed as Gasser

CALGARY — The first wildcat drilled by Royalite Oil Co., Ltd.-Canadian Fina Oil, Ltd., on a 98,400-acre crown reserve in the Saddle Hills area of northern Alberta has been completed as a gas well.

The well, Royalite Fina Saddle Hills 1, was drilled to 6,285 ft. and then plugged back to the top of the Cadotte sand. The 3,857-67-ft. interval was perforated and gas flowed at the rate of 4,000 M.c.f daily. The well is located 40 miles northwest of Grande Prairie and 28 miles southeast of the Gordondale area, where the two companies have completed six gas wells.

Husky Expanding Lloydminster

EDMONTON, Alta.—Husky Oil & Refining, Ltd., will spend $600,000 in additions to the company's Lloydminster refinery this year.

Present capacity is 5,400 bbl. of crude daily when running to asphalt and 10,000 bbl. when running to bunker oil. The new facilities will permit running all products simultaneously and processing between 8,000 and 8,500 bbl. daily.

The refinery charges low-gravity crude from Lloydminster field.

Pipe Line Permits Sought

CALGARY, Alta. — The Alberta Conservation Board will hear applications March 9 from four companies seeking to build a pipe line to serve the rapidly expanding Pembina field.

Baysel Pipelines, Ltd., a subsidiary of Bailey-Selburn Oil & Gas Co., and Pembina Pipe Line Co., Ltd., subsidiary of Mannix, Ltd., a general contracting firm, have both filed formal applications with the board. Texaco Exploration Co. and Socony-Vacuum Exploration Co. have submitted letters of intent to file an application.

Baysel and Pembina Pipe Line both propose routes northeast from the field to Edmonton. Socony and Texaco, on the other hand, are reportedly planning lines to connect with Trans Mountain Pipe Line Co.'s line. The latter would be considerably shorter than a line to Edmonton.

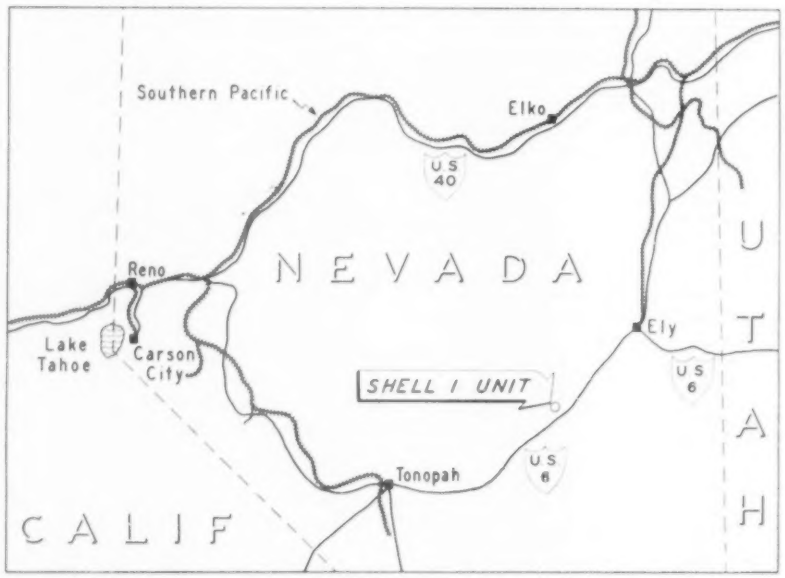
Imperial to Export Gasoline

EDMONTON, Alta.—Imperial Oil, Ltd., will be the first overseas exporter of Canadian gasoline made from Alberta crude. The company has completed negotiations for the sale of 4,500,000 gal. to Japan.

Imperial said export of gasoline to Japan was made possible by doubling of the company's refinery capacity at Ioco, B. C., and the assured supply of Alberta crude through Trans Mountain pipe line.

The gasoline will be loaded at Vancouver early in March. It will be paid for in U. S. dollars. Imperial said it hopes that this is the beginning of the development of an export market for Canadian petroleum products.

NORTHWEST



RANK WILDCAT STRIKE is that of Shell Oil Co. 55 miles southwest of Ely, Nev. The indicated discovery is about halfway between California and Utah production.

Shell Finds 350-Ft. Pay in Nevada Test

ELY, Nev.—Shell Oil Co. last week had cored 350 ft. of oil section in its rank wildcat in Nevada and was drilling ahead below 6,750 ft.

A third test of the pay zone was similar to the first, in which 2,300 ft. of 26°-gravity crude was recovered in 4 hours equivalent to a flow of about 180 bbl. a day. S. F. Bowlby, Shell vice president, said the crude is similar in character to that of the Uinta basin.

Indications were that the well would open an entirely new basin, although Shell officials said there was a question whether the well would be commercial, in view of the depth.

Bowlby said the company was unsure of the age of the producing formation but believes it to be Tertiary. The formation, he said, is pyroclastic in nature and has been recemented, making it difficult to determine whether it is marine or other deposition. The well was drilled on seismic data.

The Shell well was spudded after the most active year of geophysical and leasing work in Nevada's history. The strike confirmed a forecast that the Silver State would likely become the twenty-ninth oil-producing state in the nation *(The Oil and Gas Journal, February 8, page 185)*.

Shell's Nevada discovery is in rank wildcat territory, located about half way between California and Utah production. It is 370 airline miles northeast of Los Angeles, 390 miles east of San Francisco, 245 miles southwest of Salt Lake City, and 55 miles southwest of Ely, the nearest railhead.

Industry-Wide Union Planned

Merger of independent unions into powerful nation-wide body is goal; success of plan to be indicated in August

A PROGRAM for merging independent unions in the petroleum and related industries into one big International Oil and Chemical Workers Union was mapped out in a conference in Philadelphia last week.

A provisional constitution was adopted and a call was issued for a ratification convention in August at which time the sponsors hope a score or two of heretofore independent unions will agree to the amalgamation and formally launch the OCWU.

Delegates from 31 unions with a combined membership of 212,400 members participated in the Philadelphia conference. Their approval of the project does not bind their unions, however, as each union must vote on the merger and acceptance of the constitution.

The biggest participant was the Oil Workers International Union (CIO), with 125,000 members. If this union ratifies the amalgamation it will either have to withdraw from the Congress of Industrial Organizations or else persuade the OCWU to affiliate with the CIO. As now projected, the OCWU would be independent, but with the question of affiliation with either the CIO or the American Federation of Labor left open for future consideration.

The second-largest group in the conference was the Central States Petroleum Union with about 32,000 members, all employes of Standard Oil Co. (Ind.) in various parts of the country. Delegates from the AFL Operating Engineers Union and two AFL craft unions were also present. The other unions were all independent, representing employes of a single company or a single plant, some of them with quite small memberships.

The conference was called and organized by Maynard M. Sands, president of the Central States Petroleum Union. Voting strength at the conference was proportional to the number of members represented, which gave control to the block of delegates from the OWIU.

Interim body named . . . O. A. (Jack) Knight of Denver, president of the OWIU, was elected chairman of the interim committee which will keep the OCWU going until the ratification convention, at which time a permanent organization is scheduled to be established. Knight is a vice president of the Congress of Industrial Organizations.

No wage or other demands were outlined at the Philadelphia meeting, and the objective was described as to create a strong, unified organization to represent the welfare of all employes in the industry. Most of the independent unions have no paid employes and no affiliation with other locals.

The provisional constitution provides dues to the international OCWU of $1.35 per member per month, with provision that locals can collect such other dues as they desire so long as the combined dues are not in excess of $5 per member per month. This compares with present dues of about $3 for most OWIU locals and considerably less for most independent unions.

The scope of the projected OCWU is broad enough to take in all branches of the oil, gas, chemical, and related industries, and include all occupations normally subject to representation by collective-bargaining units. Such extension of membership might bring jurisdictional disputes and charges of raiding from other CIO and AFL unions and perhaps from the United Mine Workers and other independent unions.

What is involved . . . There are reported to be about 75 unions in the petroleum industry, most of them relatively small local groups, with a combined membership of around 500,000. Potential membership for the OCWU is probably well over 1,000,000.

Workers are most highly organized in the refining and pipe-line branches of the industry, though the OWIU has some representation in the marketing, drilling, and production branches. The AFL Operating Engineers Union and some AFL craft unions have locals in some refineries, and recently the AFL Teamsters Union has made attempts to organize employes of filling stations in some eastern cities.

Oil is one of the few big industries without a central union. Years ago collective bargaining was conducted with local employes' associations, for the most part. When the Wagner Labor Relations Act outlawed "company unions" most of these associations reorganized as independent unions and obtained bargaining status. Some of these independents are company wide; others are confined to a single plant of one company.

One of the objectives of the OWIU has been industry-wide collective bargaining, but it has not been notably successful in several attempts to achieve this. Most companies have insisted on separate contracts at each installation, negotiated individually with the local units and without reference to the terms and expiration dates of contracts with other locals.

Sinclair Oil Corp. is the only large company with a single company-wide contract with the OWIU. Other companies with OWIU contracts negotiate with each local separately.

Background . . . In the spring of 1952 a coalition was formed by the OWIU, Central States Petroleum Union, and 20 independents which conducted a strike of some 100,000 employes of six oil companies for about 11 weeks.

This put a serious dent in supplies of motor fuel, but the public did not really suffer because other oil companies kept all market outlets supplied. One of the objectives of this strike was to obtain an industry-wide contract with uniform terms and expiration date, but the strike finally ended with the various locals resuming individual negotiations with the companies.

Leaders of these same 22 unions were the principal promoters of the Philadelphia conference.

While the Philadelphia conference did not announce any specific goals, O. A. Knight later called attention to the fact that prior to World War II a 36-hour work week was quite common in refineries, but the period is now generally 40 hours. He said that if employment begins to fall off, the union can be expected to seek a shortened work week in order to provide jobs for more people.

Asked about the guaranteed annual wage, which is quite an issue in some industries with seasonal fluctuations in employment, Knight said that this is not a specific goal of his group at present but was a desirable objective since "our people eat by the year."

No specifics settled . . . Knight said that

the unions represented at Philadelphia did not agree on any specific program of wages, hours, or other contract provisions, but is interested at the present chiefly in forming a strong organization representing oil workers and capable of bargaining with big companies which operate on a national scale.

Both union spokesmen and company industrial-relations men throughout the industry are traditionally reluctant to discuss possible future developments in labor relations, but among the companies there is much doubt being expressed that the projected OCWU will grow into one, big, single, all-inclusive union any time in the near future.

Many of the independent unions have obtained better contract terms than the CIO or AFL unions, their dues are usually less, and their officers have more power and prestige than the local representatives of international unions.

Another stumbling block is expected to be the question of affiliation with one of the big labor groups. It is believed that some locals would join the OCWU if it remains independent but would not want to become a part of the CIO or AFL. While Knight professes open-mindedness on this question, many observers think it is inconceivable that he would resign his vice presidency in the Congress of Industrial Organizations and lead his OWIU out of the CIO, except, perhaps, as a temporary expediency.

Company attitude . . . It is taken for granted that most oil companies will do everything in their power to avoid industry-wide bargaining and a single contract for all companies and employes.

The present method of separate contracts in each locality permits recognition of lower living costs, higher operating costs, and other local conditions, with the result that wages are somewhat lower, generally speaking, at refineries of smaller companies and in smaller communities.

On the other hand, a few companies are said to be dissatisfied with independent unions which at times tend to be irresponsible, be poorly led, and make innumerable petty demands, in contrast to the international unions with paid employes which operate on a businesslike basis and discipline their members better.

Assuming that the OCWU becomes a reality this fall, there will not necessarily be any immediate change in existing labor conditions. Contracts would remain in force until the dates set for expiration or renegotiation.

In some cases the new union could be substituted for the old by mutual consent, but in other cases it might be necessary for the National Labor Relations Board to conduct a certification election to determine whether or not the OCWU is to represent the employes of a given plant. Such an election, of course, could result in the union losing out entirely.

Another assumption is that the new union will work for uniform expiration dates of all contracts, or for contract clauses prohibiting a company from running crude or servicing the marketing outlets of another company closed by a strike. One past obstacle to industry-wide bargaining and uniform contracts has been that during a strike of some companies the other companies usually take over the crude-purchasing obligations of the struck concerns and keep their customers supplied with products.

This practice has prevented much public suffering during refinery strikes. A general shut-down of the greater part of the oil industry would paralyze the nation within a week or two and bring demands for federal seizure of the industry or intervention to force a quick settlement.

Industry Briefs

CALGARY, Alta.—Northwest Utilities, Ltd., has completed plans for construction of a 42-mile natural-gas line from Bonnie Glen and Wizard Lake fields to Edmonton. The firm estimates cost of the line at $1,344,000.

OTTAWA, Ont. — Proposed construction by Tennessee Gas Transmission Co., Houston, of a 75-mile pipe line to carry U.S. natural gas from near Buffalo, N. Y., to Toronto has been approved by the Canadian senate and now must go before the country's parliament for final approval.

REGINA, Sask. — A 31,000-bbl. daily feeder pipe line linking the east edge of Smiley field and the Interprovincial Pipe Line Co.'s line at Kerrobert pump station will be built by Mid-Saskatchewan Pipe Lines, Ltd.

REGINA, Sask. — Saskatchewan's 1953 crude production totaled 2,800,000 bbl., more than 1,000,000 bbl. over the previous year's production and 19 times 1946 production, according to figures released by the Department of Mineral Resources.

DENVER. — Colorado's oil-producing property will be taxed in 1954 on a valuation based on 87½ per cent of the oil and gas produced. The tax commission boosted the valuation percentage from the 75 per cent on which 1953 taxes were assessed after a conference here with assessors and commissioners from oil-producing counties.

Process Unveiled

Socony-Vacuum develops fixed-bed "Sovaforming"

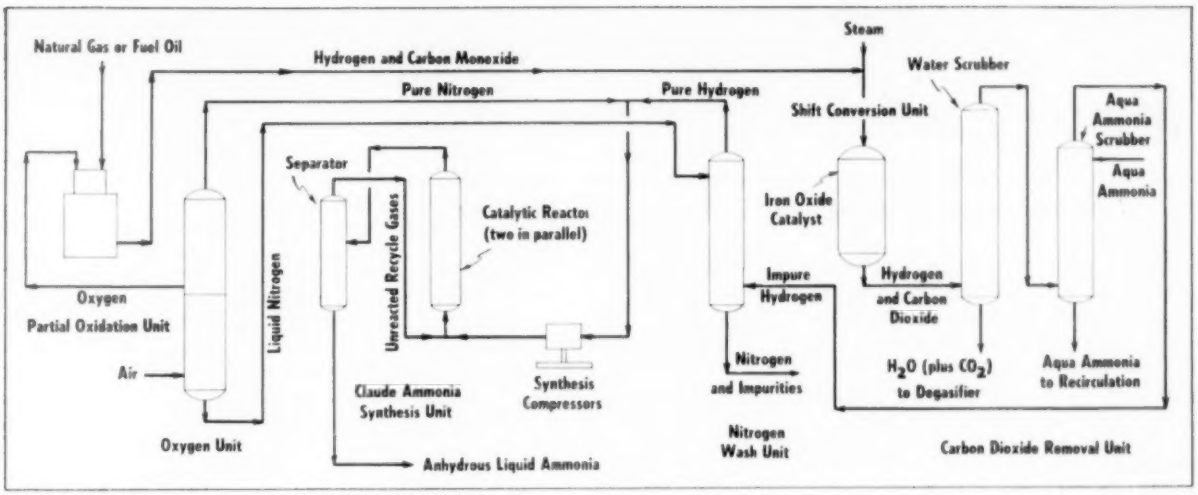
NEW YORK.—The latest in a growing list of catalytic reforming processes is Sovaforming, recently revealed by Socony-Vacuum Oil Co., Inc. The process will employ a catalyst containing platinum, and will operate on the fixed-bed principle.

This is the second catalytic reforming process to come out of Socony-Vacuum Laboratories. The first was Thermofor catalytic reforming (T.C.R) which uses a chromia-alumina catalyst and incorporates continuous catalyst regeneration by means of the moving-bed principle also employed in the Thermofor catalytic cracking (T.C.C.) process.

T.C.R., according to Socony-Vacuum, is a very flexible process. Because of the nature of the catalyst and the facilities for continuous regeneration, this process can successfully reform high sulfur, low octane cracked naphthas to produce high blending stocks for motor fuel or aviation gasoline. In some refineries, however, the raw feed for reforming consists of low sulfur straightrun naphtha which can be reformed without imposing regenerative requirements. To meet this need, Sovaforming can be installed at lower cost.

Substitutions . . . Hence, the newer process is being substituted in two cases originally slated for T.C.R. units. Instead of T.C.R., the company will use Sovaforming for the 3,000-bbl. per day unit under construction at Socony-Vacuum's Augusta, Kansas, refinery, and the 6,000 to 8,000-bbl. per day unit contracted for the new Ferndale, Washington, refinery being built by General Petroleum Corp. Two 17,000-bbl. per day T.C.R. units are being built at General Petroleum's Torrance refinery and Magnolia Petroleum Co.'s Beaumont refinery, as originally planned, since the available feedstocks at these refineries will require the use of that process.

Sovaforming brings to 11, the number of catalytic reforming processes which have been developed in this country. It is the sixth to use a platinum catalyst. Altogether, over 600,000 bbl. per day in catalytic reforming capacity is either in operation or contracted for U. S. refineries. Of this total, units totalling 425,000 bbl. per day will use platinum catalysts.



New Synthesis Plant Puts . . .

Salt Lake in Ammonia Race

SALT LAKE CITY.—The latest project in the current $170,000,000 ammonia building program is that of Salt Lake Chemical Co. here with a plant designed to make 120 tons per day of ammonia and 30 tons of dry ice.

This new plant will employ a different combination of process steps including: (1) partial oxidation; (2) water scrubbing for CO_2 removal; (3) nitrogen wash, and (4) Claude ammonia synthesis at 10,000 psi.

Detailed engineering is now in progress by Tears Engineers of Dallas. Construction is scheduled to start in the second quarter of 1954 with completion estimated for the third quarter of 1955. A 100-acre site has been selected in "Industrial Center" 2 miles west of the Salt Lake City limits. Cost of the plant is estimated to be near $6,000,000.

Hydrogen for the ammonia synthesis will be obtained by partial oxidation of natural gas with oxygen followed by shift conversion and purification. Some 3,600,000 cu. ft. per day of natural gas will be required. The gas will be obtained from the Mountain Fuel Supply Co. of Utah.

This will be the fifth ammonia plant to employ the partial oxidation method. The first was that of Spencer Chemical Co. at Vicksburg, Miss., which has just recently gone on stream *(The Oil and Gas Journal, February 8, page 60)*. Three more plants, now building and scheduled to be on stream this year, will employ this process. These plants are: Grand River Chemical Division of Deere & Co. at Pryor, Okla.; Grace Chemical Co. at Memphis, Tenn., and Cooperative Farm Chemicals Corp. at Lawrence, Kans.

The partial oxidation gas generation units of the Salt Lake plant will be designed for fuel oil standby. This will take care of the 5 per cent gas downtime anticipated during peak gas demand periods.

Process steps . . . Gas purification will be by water and aqua ammonia scrubbing to remove the carbon dioxide, with final purification by liquid nitrogen wash. A guard converter (methanator) will not be used. Unreacted gases will be recycled by a circulator rather than an injector as in the Casale process. The Claude medium high-pressure process (10,000 psi.), by Societe Chimique de la Grande Paroisse, will be employed. Two 10,000-psi. converters will be used for the ammonia synthesis.

The process steps are indicated in the accompanying flowsheet.

Air separation . . . Air is compressed and separated in a tonnage oxygen unit by distillation at low temperature. Products of the air separation plant are a gaseous stream of oxygen (95 per cent pure), a pure gaseous stream of nitrogen and a stream of liquid nitrogen.

Partial oxidation . . . Natural gas or fuel oil is partially burned (oxidized) by the oxygen from the air separation unit at an intermediate pressure and at a temperature above 2000°F. Careful control of combustion conditions insures production of a gas stream containing a maximum of hydrogen and carbon monoxide in approximately equal proportions.

Shift conversion . . . Steam is converted into hydrogen by reaction with the carbon monoxide in the synthesis gas at a high temperature over an iron catalyst. The hydrogen produced in this step equals in amount the carbon monoxide consumed. An equal volume of carbon dioxide is also produced. Net result, after shift conversion, is a synthesis gas consisting of two parts of hydrogen and one part of carbon dioxide available for further processing. Small amounts of impurities such as carbon monoxide and unconverted methane are also present.

Carbon dioxide removal . . . This will be accomplished at the Salt Lake plant by water absorption, with carbon dioxide recovered, compressed to liquid carbonic and solidified as dry ice. Water scrubbing will be followed by aqua ammonia scrub.

Nitrogen wash . . . Following removal of carbon dioxide, the synthesis gas stream consists of hydrogen with small amounts of other gases. These impurities are condensed by scrubbing with the cold stream of liquid nitrogen in a nitrogen wash tower. A stream of pure hydrogen with some nitrogen results.

Claude ammonia synthesis . . . A pure nitrogen stream from the air separation plant is added to obtain a ratio of 3 to 1, hydrogen to nitrogen, and the synthesis gas compressed to 10,000 psi.

More Tanker Charges

Latest grand jury indictments name Stavros Niarchos, owner of world's largest tanker launched in February

WASHINGTON.—Five sealed indictments returned by a federal grand jury here April 23 charge 18 individuals and seven corporations with conspiring to defraud the United States in the purchase of surplus government tankers and cargo ships.

The indictments were kept secret for 10 months apparently in the hope that three of the defendants living abroad would return to the United States. They were released by Attorney General Herbert Brownell, Jr., when it became apparent that Stavros Niarchos, George N. Emmanuel and Constantine Emmanuel would remain abroad.

Niarchos recently launched the world's largest tanker, the World Glory, at a Massachusetts shipyard *(The Oil and Gas Journal, February 22, page 107)* and last week announced that two even larger tankers have been ordered from a British shipbuilding firm *(see International)*.

Second indictment . . . The latest indictments are closely related to others revealed February 8 carrying similar charges against A. S. Onassis, an Argentine citizen of Greek extraction who has made an agreement with the Saudi Arabian government to carry Arabian oil *(The Oil and Gas Journal, February 22, page 122)*. Those first indictments named eight other individuals including former Massachusetts Congressman Joseph E. Casey, who was also named in the second indictments.

Niarchos and Onassis, both of whom have extensive shipping holdings over the world, are married to sisters.

Others named in the latest indictments were Julius C. Holmes, former United States minister to London; May Dracopoulos, a sister of Niarchos; Ambrose Capparis, George Trypanis, David Dorn, Robert A. Murphy and Ralph R. Matregrano, officers or employes of the North American Shipping and Trading Co., Inc.; Charles Augenthaler and Hugh Reid, partners in Simpson, Spence and Young, New York shipping agents; Edwin J. Maas, former comptroller of North American; George D. McCarthy, of the New York accounting firm of Price, Waterhouse and Co.; E. Stanley Klein, New York financier; Delmon W. White of San Pedro, Calif., vice president of the American Pacific Steamship Co., and Willard Walter, Washington, D. C., a director of American Pacific.

The firms indicted were the North American Shipping and Trading Co.; Compania Internacional de Vapores, Ltda., a Panamanian corporation; Plymouth Tanker Corp., American Pacific Steamship Co. and Delaware Tanker Corp., subsidiaries of North American; Oriental Tanker Corp., a related corporation of North American, and American Overseas Tanker Corp.

The charges . . . The government charges North American, its subsidiaries and related companies acquired a total of 14 T-2 tankers and 6 cargo vessels for $24,307,488.23, all purchased under mortgage to the government except 6 tankers, 5 of which were acquired by purchase by Niarchos of the stock of American Overseas Tanker Corp.

The Maritime Administration, earlier last month, demanded the return of the five tankers acquired from American Overseas through the purchase of the company's stock by Niarchos' Delaware Tanker Corp.

Seventeen of the defendants are charged in one indictment with conspiracy to defraud and violation of the false statements statute by falsely describing North American as controlled by United States citizens and by filing false financial statements, balance sheets and other documents in connection with the purchase and charter of vessels.

Another indictment charges 15 defendants with conspiracy to violate the law by changing the American citizen ownership of five tankers by means of sale of all capital stock of American Overseas without Maritime Administration approval. The third indictment charges 15 defendants with misrepresenting the citizenship of American Pacific in an application for the purchase of vessels and with filing false financial statements and affidavits.

The fourth indictment charges American Pacific and Murphy with chartering an American flag vessel to an alien without Maritime approval, and the fifth indictment charges Maas with perjury before the grand jury in testifying falsely that he had filed a financial statement for North American with the Maritime Administration for the year 1947.

Lake Charles Refinery Adding New Fluid Hydroformer

Construction is at the half-way point in a major expansion program for Cities Service Refining Corp.'s Lake Charles refinery. Shown here are foundations and columns for a 17,250-bbl. fluid Hydroformer to be used for upgrading a variety of low-octane naphthas to high-octane aviation and motor gasoline. Design, engineering, and construction are all being handled by M. W. Kellogg Co.

U.S. Financed Oil

Foreign purchases of oil, products near $1.5 billion

WASHINGTON.—Purchase of more than $1,500,000,000 worth of petroleum and products by foreign countries has been financed by the United States government over the past 6 years under the Marshall Plan and successor foreign aid programs.

The greater part of this financing was done in the first 4 years of the Marshall Plan. The financing of oil toward the end of last year was down to a level of about $10,000,000 a month, it is shown by a report of the Foreign Operations Administration, successor to the Economic Cooperation Administration and the Mutual Security Administration.

Between April 3, 1948, when Marshall Plan operations started, and the end of last October, shipments of petroleum and products to the participating countries reached a total of $1,481,900,000. Another $24,742,000 worth of oil was provided under the Far East program which started June 5, 1950.

The oil financed by the United States went to 17 European countries in amounts ranging from $1,700,000 to $455,000,000, the FOA reported.

Iran Plan Challenged

Independent refiners object to "selected few" involved

WASHINGTON. — Independent domestic refiners last week challenged the proposed arrangements for the return of Iranian oil to the world market as perpetuating rather than minimizing the problems of imports.

In a letter to Secretary of State John Foster Dulles, President Eisenhower and Attorney General Herbert Brownell, Elmer E. Batzell, counsel for the Independent Refiners Association of America, declared the proposed agreement "limits the opportunity of foreign oil to only a selected few large organizations." He charges it is not in keeping with traditional American foreign policy or with the interests of American operators "who should be entitled to share in supplies of foreign oil which can be imported into this country on a basis consistent with the over-all best interests of the domestic industry."

On the contrary, Batzell asserted, "the proposed solution of the Iranian question has apparently been one which has been limited to the same companies and organizations which today provide the bulk of imports giving rise to the economic problems mentioned."

Batzell pointed out that the desirability of a solution to the import problem was given extensive attention in Congress last year, and expressed the expectation it would be considered again this session.

"The present negotiations with Iran, that we have thus far noted, indicate no concern by the Department of State with the problem of current over-supplies of petroleum and its effect upon the health and welfare of American industries, nor do the negotiations indicate adherence to the principle of equal opportunity whereby if, as, in, and when in the future additional supplies of petroleum are needed in this country, American operators may be assured of an opportunity to secure those supplies on an equitable basis," Batzell charged.

Phillips Argument Set

WASHINGTON.—Argument in the Phillips Petroleum Co. case, involving the jurisdiction of the Federal Power Commission over producers and gatherers of natural gas, will be heard by the Supreme Court during the week of April 5.

Since the court customarily adjourns for the summer early in June, however, it is possible the final decision in this case may not come until it reconvenes for the 1954-55 session next October.

Whether the sale of natural gas to interstate pipe lines at natural-gasoline plants subjects the seller to the authority of the FPC is the issue.

Observers in Washington saw a possible hint of the position the court will take, in its opinion last month invalidating the Texas gas-gathering tax applied to sales of gas at the outlet of gasoline plants. The court held that at that point production and "processing have ceased and transmission in interstate commerce has begun" and the gas at that time "is not only actually committed to but is moving in interstate commerce."

With a decision in the case not possible until shortly before Congress adjourns, at the earliest, the issue of amendment of the Natural Gas Act in an election year has been eliminated. State officials and spokesmen for the gas industry have declared intention of pressing for an amendment more specifically exempting producers and gatherers from FPC jurisdiction if the decision of the lower court, holding Phillips subject to commission control, is affirmed. Congressional leaders, however, have indicated firmly that they would not take up such a political "hot potato" this year.

Seized Tanker Ordered Sold

WASHINGTON.—The Department of Justice announced last week that the 10,448-ton T-2 tanker Ampac Washington, seized in the government's program to recover surplus vessels controlled by aliens in violation of law, will be sold at public auction at Baltimore, March 19.

The sale was ordered by the federal District Court at Baltimore on motion of the holder of a mortgage on the vessel, and the proceeds will stand in place of the ship subject to determination by the court of the libel action filed by the government when the tanker was seized last September.

The Ampac Washington was sold by the Maritime Commission to the American Pacific Steamship Co. in 1948 and allegedly later was transferred to alien ownership.

In its drive to recover illegally transferred vessels the department has seized 37 tankers and dry cargo ships. The ships have been allowed to continue in operation under an order designating their masters and first mates as deputy United States marshals, thus keeping the vessels in legal custody of the court, and all proceeds accruing from their operation are retained under court control.

FPC Legislation Pressed

WASHINGTON. — Legislation to change rate-suspension procedures of the Federal Power Commission has been introduced in Congress and members from gas consuming states are expected to press for its passage.

The measure would increase from 5 to 15 months the period for which the FPC could suspend applications for new rate schedules of interstate pipe lines pending a hearing. It was introduced in the House by Rep. Roy W. Wier and in the Senate by Sen. Hubert H. Humphrey, both of Minnesota.

The commission would be given new authority to order interim rates during the period of suspension if records proved a need and companies would not be required to refund increases if the schedule were eventually denied.

It was charged that at present companies apply for new increases before previous applications have been acted upon and as a result are pyramiding rates faster than the commission can act upon them.

Crude Imports to Rise

Forecasts furnished Texas Railroad Commission indicate products imports will decline in normal seasonal trend

CRUDE imports in the second quarter will be higher than the December-January average and product imports will be down if importing companies carry out plans indicated by reports to the Texas Railroad Commission.

These forecasts of imports through the second quarter were filed by companies making nominations for Texas crude in March.

Preliminary figures of the 13 companies reporting imports of crude show a December average of 609,700 bbl. daily and 600,800 bbl. daily in January. The same companies had estimated earlier that January crude imports would average about 617,000 bbl. daily.

Crude receipts for February are estimated at 651,600 bbl. daily. Total crude is expected to drop slightly in March and more in April before going back up in the last 2 months of the second quarter. These import plans tend to follow the normal trend in refinery runs. Refinery throughput decreases in the period between winter and summer demand peaks.

Product imports by the reporting companies averaged about 436,000 bbl. daily in December and 451,000 bbl. daily in January. February receipts were estimated at 494,000 bbl. daily. Decreases are expected for each succeeding month through the second quarter. The June average is forecast at about 312,000 bbl. daily. Since residual fuel makes up most of the product import total, these product receipts tend to follow the seasonal trend in residual fuel demand.

The product totals include bonded fuel, most of which is brought in duty free for bunkering ships in foreign trade. Sales of this bonded material are included in domestic demand as reported by the Bureau of Mines.

The small table shows that the reports to the Texas Railroad Commission cover most imports of crude but do not include about 15 per cent of product imports. The reported totals account for about 90 to 95 per cent of all imports.

IMPORTS*
(Thousands of barrels daily)

	—Actual—		—Estimated or forecast—				
	Dec. 1953	Jan. 1954	Feb. 1954	March 1954	April 1954	May 1954	June 1954
Crude—East Coast:							
The Atlantic Refining Co.	63.3	60.1	65.8	65.8	65.8	65.8	65.8
Cities Service Co.	8.1	2.4	9.1	5.5	5.7	8.1	5.7
Eastern States Pet. Co.		0.9	6.0	6.0	5.0	5.0	5.0
Gulf Oil Corp.	118.0	100.0	103.0	121.0	105.0	111.0	115.0
Phillips Petroleum Co.	6.4	6.3	7.1	6.4	6.7	6.4	6.6
Sinclair Oil Corp.	61.8	68.9	66.0	66.0	66.0	66.0	66.0
Socony-Vacuum Oil Co.	88.1	90.3	88.7	88.7	88.7	88.7	88.7
Standard Oil Co. of Calif.	66.7	59.6	72.6	72.6	72.6	72.6	72.6
Standard Oil Co. (Ind.)		9.9	14.6	9.9	14.0	15.0	13.0
Standard Oil Co. (N. J.)†	83.0	81.0	81.0	81.0	81.0	81.0	81.0
Sun Oil Co.	18.3	22.1	16.0	7.3	7.5	14.5	15.0
The Texas Co.	47.1	63.0	52.9	48.5	40.0	53.0	53.0
Total East Coast	560.8	564.5	582.8	578.7	558.0	587.1	587.4
Crude—West Coast:							
Standard Oil Co. of Calif.	27.0	30.9	33.6	33.6	33.6	33.6	33.6
Tide Water Associated Oil Co.	10.7		22.8	14.1	12.9	15.8	12.5
The Texas Co.	11.2	5.4	12.4	5.5	15.0	16.0	15.0
Total West Coast	48.9	36.3	68.8	53.2	61.5	65.4	61.1
Total United States	609.7	600.8	651.6	631.9	619.5	652.5	648.5
Products:							
Asiatic Petroleum Corp.	2.0	1.1	6.9	6.7	4.3	5.5	8.0
Eastern States Pet. Co.	15.5	26.5	26.0	26.0	20.0	20.0	20.0
Gulf Oil Corp.	20.0	12.0	12.0	9.0	14.0	14.0	10.0
Shell Caribbean Pet. Co.‡	154.0	170.0	160.0	130.0	105.0	80.0	80.0
Shell Oil Co.	14.0	8.8	22.9	16.8	16.3	15.8	16.3
Socony-Vacuum Oil Co.	6.8	6.4	9.0	9.0	9.5	9.5	9.5
Standard Oil Co. (Ind.)§	15.5	24.8	31.5	18.9	23.9	19.8	17.2
Standard Oil Co. (N. J.)†	198.0	194.0	215.0	215.0	143.0	143.0	143.0
The Texas Co.	9.9	6.9	13.8	3.4	8.5	8.4	8.5
Total products	435.7	450.5	494.1	434.8	344.5	316.0	312.5
Total crude and products	1,045.4	1,051.3	1,145.7	1,066.8	964.0	968.5	961.0
Bonded oil included¶	50.8	54.5	69.1	68.9	62.1	63.3	65.8

*From company reports to the Texas Railroad Commission. †Based on quarterly estimates. ‡Imported by independent distributors. §Received through suppliers who can furnish either domestic or foreign oil. ¶Mostly duty free for bunkering ships in foreign trade.

IMPORT COMPARISONS—SELECTED MONTHS
(Thousands of barrels daily)

Companies reporting:*	Feb. 1953	April 1953	July 1953	Sept. 1953
Crude	564.3	607.3	623.4	666.0
Products	398.6	332.3	239.0	283.0
Total	962.9	939.6	862.4	949.0
Total imports:†				
Crude	581.9	617.2	622.2	729.2
Products	479.1	373.1	314.6	320.0
Total	1,061.0	990.3	936.8	1,049.2
Company data:	—Per cent of total imports—			
Crude	97.0	98.4	100.2	91.3
Products	83.2	89.1	76.0	88.4
Total	90.8	94.9	92.1	90.4

*Reports to the Texas Railroad Commission. †From Department of Commerce.

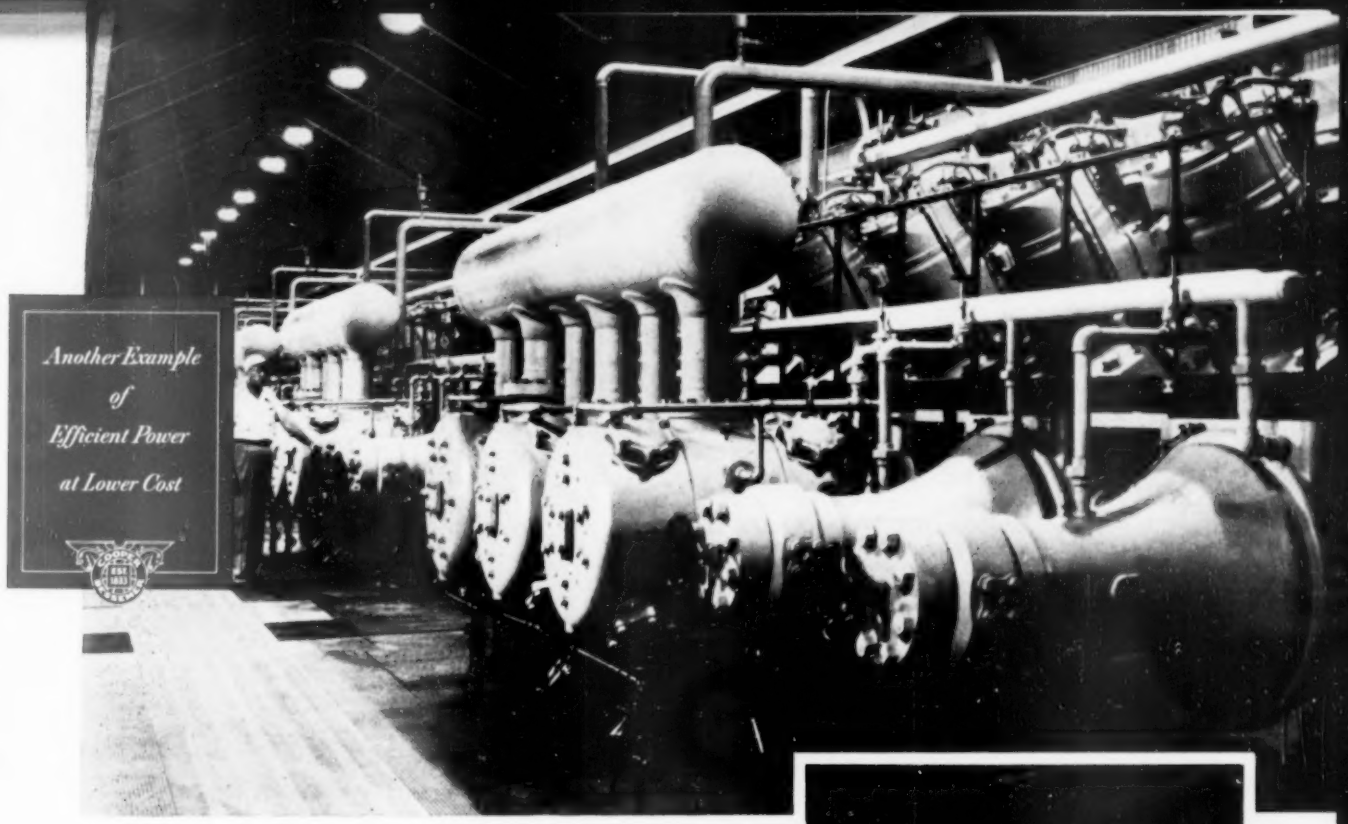
Imports, Exports Up

Venezuela imports lose ground to Middle East oil

BOTH imports and exports increased in December, according to data compiled by the Census Bureau of the Department of Commerce.

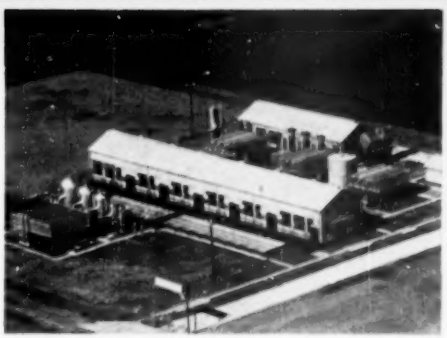
Crude imports for the month averaged 640,000 bbl. daily for an increase of 43,000 bbl. daily over November but a decrease of 10,000 bbl. daily from the average for December 1952. The average for December was down 89,200 bbl. daily from the all-time high in September. Crude import averages for 4 months of 1953 were above December.

The December increase resulted from a gain of 34,700 bbl. daily in receipts from Venezuela. However, crude imports from Venezuela averaged 321,500



Line-up of six 4-stage GMV's, totaling 6,850 horsepower, in Willamar Pressure Maintenance Plant. First two stages compress 50-pound gas to 300 pounds. This gas and 300-pound field gas is then compressed for injection to 3,000 pounds absolute in remaining two stages.

Willamar Pressure Maintenance Plant, Willacy County, Texas; engineered, designed and constructed by O. L. Olsen Co., Houston; operated by Pan American Production Co., under unitization agreement.



PRESSURE MAINTENANCE AT WILLAMAR...WITH *GMV's*

...Another big step in gas conservation

In the summer of 1951 flares were killed throughout the Willamar West field and Cooper-Bessemer GMV-angle compressors went on the line in one of the biggest repressuring jobs of its kind. Starting with 6 GMV's totaling 6,850 horsepower, and an initial capacity of 33 million cubic feet of gas a day, it is another important step in conserving Southwest Texas gas. The plant is designed for easy and economical expansion to an ultimate capacity of 58 million cubic feet a day.

A feature of the ultra-modern Willamar plant is its extreme flexibility. It permits efficient operation under widely varying conditions of gas pressure and volume — a decided advantage due to uncertainties in the trend of the field's gas production.

And, speaking of flexibility, that's also a long-recognized GMV feature — one that *often* permits big savings in meeting initial and subsequent requirements. But get the *whole* GMV story. It makes sense in dollars saved and performance gained in *all* kinds of compressor service.

MOUNT VERNON, OHIO

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New York • Chicago • Washington • San Francisco • Los Angeles • San Diego • Houston • Dallas • Odessa • Pampa • Greggton • Seattle • Tulsa • St. Louis • Gloucester • New Orleans • Shreveport
Cooper-Bessemer of Canada, Ltd., Edmonton, Canada

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS • HIGH PRESSURE LIQUID PUMPS

bbl. daily for the year 1953 compared with 326,000 bbl. daily in 1952.

Crude imports from the Middle East decreased for the month of December but increased for the year. The December average was 206,700 bbl. daily compared with 209,600 bbl. daily for November. The daily average for the entire year was about 218,000 bbl. compared with 151,000 bbl. for 1952.

Imports of heavy fuel tend to follow the seasonal demand trend of higher consumption during the winter months. Residual imports averaged 486,900 bbl. daily in December compared with 433,200 bbl. daily in November and 331,800 bbl. daily in October. However, the December total for heavy fuel was about 51,000 bbl. daily less than for either December 1952 or January 1953.

Crude exports for December averaged 44,500 bbl. daily, the highest month since June. Gasoline exports decreased 9,400 bbl. daily from November, and residual decreased 14,900 bbl. daily. The relatively large increase reported for other products was due to gains in shipments of L.P.G., asphalt, and coke.

IMPORTS INTO CONTINENTAL UNITED STATES
(Thousands of barrels)

	Dec. 1953	Nov. 1953	Dec. 1952
Crude—			
Mexico	280	180	709
Colombia	1,100	1,066	1,335
Venezuela	10,405	9,027	10,108
Kuwait	3,232	3,213	3,337
Saudi Arabia	2,960	2,445	3,543
Iraq		103	342
Qatar	214	527	
Canada	305	183	96
Far East	1,346	1,175	671
Total crude	19,842	17,919	20,141
Daily average	640	597	650
Products—			
Residual fuel	15,093	12,997	16,681
Other products	872	887	741
Total products	15,965	13,884	17,422
Daily average	515	463	562
Total all oils	35,807	31,803	37,563
Daily average	1,155	1,060	1,212

EXPORTS*

	Dec. 1953	Nov. 1953	Dec.† 1952
Crude	1,378	1,052	2,960
Gasoline	2,401	2,604	3,865
Kerosine	623	489	370
Distillate	2,337	2,150	2,526
Residual	1,514	1,912	1,292
Lube oils	1,261	1,183	911
Other products	988	625	739
Total all oils	10,502	10,015	12,663
Daily average	339	334	408

*Excludes shipments to territories. †Revised.

Inventories Normal

Little change in secondary stocks at the end of 1953

WASHINGTON. — Stocks of major products in bulk stations of refiner-marketers and jobbers and distributing terminals of jobbers (secondary inventories) totaled 51,107,000 bbl. at the close of 1953, compared with 51,798,000 bbl. a year earlier.

Withdrawals from stocks during the month of December amounted to 3,374,000 bbl., compared with 3,608,000 bbl. in December 1952, according to the monthly report of the Census Bureau.

During the month, the bureau said, distillate fuel inventories dropped 2,146,000 bbl., gasoline 525,000 bbl., kerosine 216,000 bbl. and residual fuels 487,000 bbl.

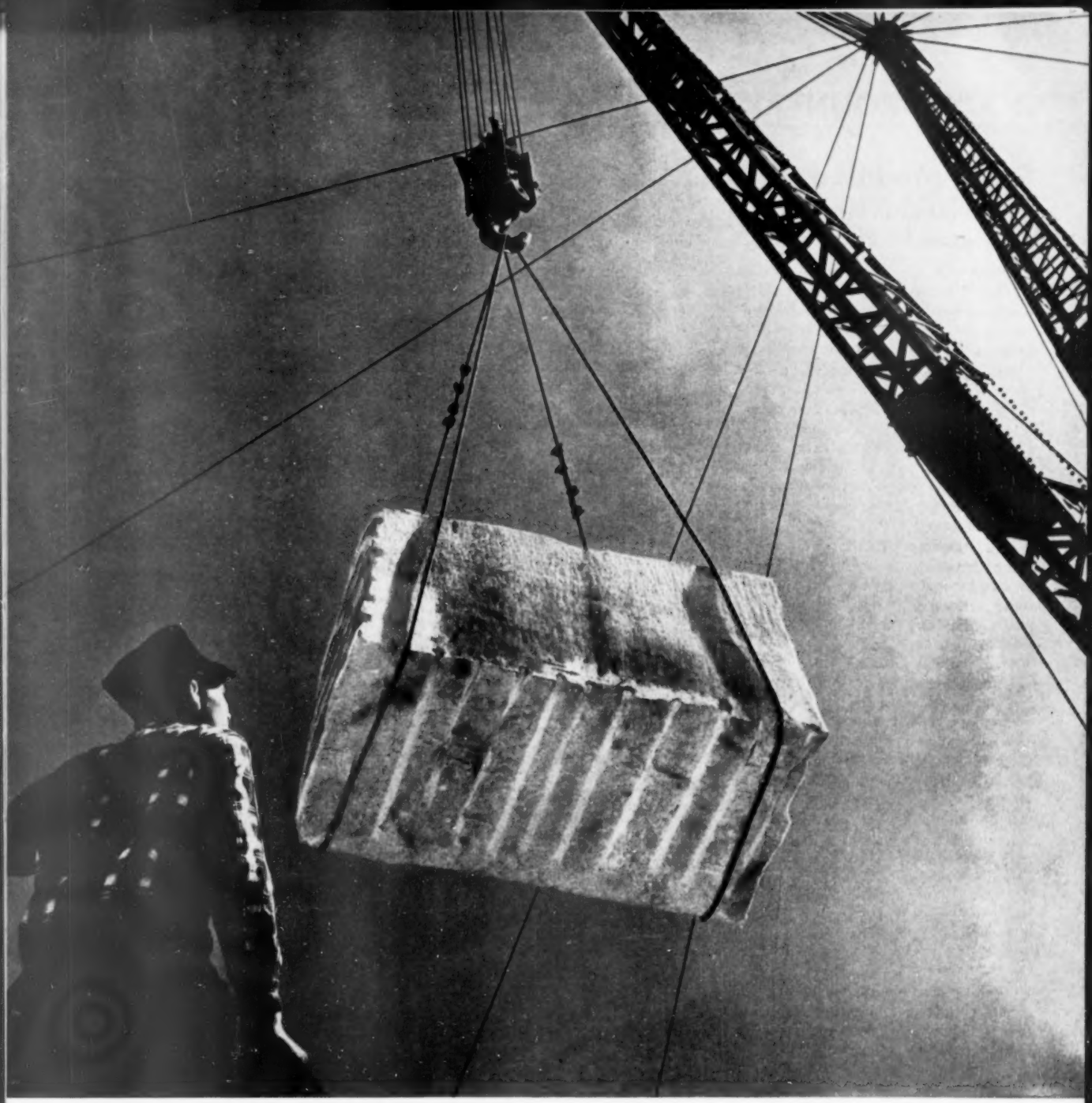
All areas showed a drop in total inventories in December except District 3, where they increased slightly due to heavier holdings of gasoline and residual fuels. Year-end stocks were under 1952 in all areas except Districts 4 and 5.

Inventories held in the several districts on December 31, compared with those of November 30, 1953 and December 31, 1952, are shown in the accompanying table, in thousands of barrels.

	Dec. 31, 1953	Nov. 30, 1953	Dec. 31, 1952
Gasoline			
PAD 1	5,028	5,164	5,341
PAD 2	7,990	8,202	7,960
PAD 3	2,441	2,318	2,549
PAD 4	924	949	863
PAD 5	2,066	2,341	2,012
Total U. S.	18,449	18,974	18,725
Kerosine			
PAD 1	2,966	3,157	2,890
PAD 2	3,424	3,444	3,458
PAD 3	587	599	665
PAD 4	89	87	98
PAD 5	101	96	107
Total U. S.	7,167	7,383	7,218
Distillate			
PAD 1	10,534	11,819	10,401
PAD 2	6,211	6,579	6,494
PAD 3	770	844	835
PAD 4	479	504	483
PAD 5	1,160	1,554	1,150
Total U. S.	19,154	21,300	19,363
Residual			
PAD 1	4,224	4,526	4,402
PAD 2	1,606	1,502	1,707
PAD 3	338	328	217
PAD 4	5	10	6
PAD 5	164	458	160
Total U. S.	6,337	6,824	6,492
Four Products			
PAD 1	22,752	24,666	23,034
PAD 2	19,231	19,727	19,619
PAD 3	4,136	4,089	4,266
PAD 4	1,497	1,550	1,450
PAD 5	3,491	4,449	3,429
Total U. S.	51,107	54,481	51,798

A Seismograph Shot Caused This

More than 2 years ago a seismic shot in Alberta tapped a water strata and resulted in an artesian well. The water scoured out the dirt and eventually created a pool 30 ft. deep and 60 ft. across. This 25-ton tractor fell through the ice during a winter job of clearing snow from an access road for Cities Service Petroleum Co., 75 miles east of Nampa. Pumps lowered the water level 12 ft., but efforts to recover the cat with winch trucks and other salvaging equipment failed. A professional diver was hired, but because of the murky, swirling water was unable to make a satisfactory hitch. Nearly 2 years later, a salvage company contracted the job and after 3 months of hard work succeeded in raising the tractor. The result? In spite of its ordeal, the tractor is now back in operation after replacement of its bearings, gaskets, grease seals, and other damaged parts.



Wire Rope at Work—Some of the world's most beautiful marble comes from the eighteen quarries of the Georgia Marble Company. Through the years this firm has removed and marketed over 30,000,000 cu ft of the durable crystalline stone, which can be seen in famed buildings and memorials in every state of the Union.

The block shown in the picture, a dozen tons of particularly fine white marble, was photographed emerging from one of the company quarries near Tate, Ga. This handling job involved a lift of 175 ft, and the hoisting was done by a stiffleg derrick equipped with sound, dependable Bethlehem wire rope. Here, as always, the Bethlehem rope met every demand with plenty to spare, for it is a product made to take such loads in stride.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

MINING • CONSTRUCTION • PETROLEUM • EXCAVATING • QUARRYING • LOGGING • MANUFACTURING

Rules Modified

North Dakota sets higher flow rate for discoveries

BISMARCK, N. D.—The North Dakota Industrial Commission last week amended its proration rule to provide a discovery allowable for the first four wells drilled in any new field.

Effective March 1 a daily allowable of 200 bbl. will be in effect in new fields for 18 months after completion of the discovery well or until the fifth well is completed, whichever comes first, providing a market exists for the crude. Upon completion of the fifth well the field will come under the regular proration schedule.

The amendment resulted from a special hearing held to consider complaints of independent operators that the February allowable of 18 bbl. daily for wells 5,000 ft. and less in depth was keeping risk capital out of North Dakota.

Under present regulations the normal allowable is based on a well 5,000 ft. or less drilled on a 40-acre tract. The allowable increas " in proportion to depth of wells and . also is multiplied for fields on spacing wider than 40 acres.

Thus, Stanolind Oil & Gas Co.'s 1 Starr in McKenzie County has a February allowable of 336 bbl. daily because it is producing from between 10,000 to 11,000 ft. and is entitled to 4.67 times the normal unit allowable. Since it is on 160-acre spacing this is multiplied by four.

Unlimited production sought . . . A group of independents proposed unlimited production for the first five wells for 18 months if that production did not result in waste. Stanolind suggested a 50-bbl. daily allowable for the first five wells for a year, while Dr. Wilson M. Laird, state geologist, proposed a 50-bbl. bonus for discovery wells under 5,000 ft.

Leonard Ward, of Mount Pleasant, Mich., who has drilled the bulk of Bottineau producers, testified the present allowable would require "at least 15 years" to recoup his investment. Others testified the low allowable was a major factor in retarding exploration on the eastern flank of the Williston basin.

Clifford Jansonius, Bismarck attorney representing the independents, told the commission he doubted that the depth factor provision would stand up in court and said the allowables should be based upon field and well potentials.

Proration by market demand was provided in a revised conservation law adopted by the 1953 North Dakota Legislature.

Carter Finds Bakken Oil

WILLISTON, N. D.—Carter Oil Co. et al have recovered the first free oil from the Bakken (basal Mississippian) in North Dakota in their Carsin area wildcat in Dunn County, in the western part of the state.

Recovery at the 1 Lockwood was 30 ft. of free oil. Some shows have been found previously in the Bakken, but this is the first time free oil has been recovered. Oil also was found in the upper Mississippian.

Railroad Signs Agreements

BILLINGS, Mont. — Northern Pacific Railway Co. has concluded four more agreements for oil and gas exploration on company lands in North Dakota and Montana.

The agreements, all involving a drilling commitment, are with:

Stanolind Oil & Gas Co., in the Gorham area of Billings County, North Dakota, Township 143n-100w, about 25 miles north of Fryburg field.

William Herbert Hunt, in the Dickinson area of Stark County, North Dakota. Hunt has started the 1 Kudrna 10 miles southwest of Dickinson in the C SW NW 20-139n-97w.

Heep Oil Co., in the northwest Woman's Pocket area, Golden Valley County, Montana.

Shell Oil Co., Coral Creek unit, Fallon County, Montana.

Montana Leases Sold

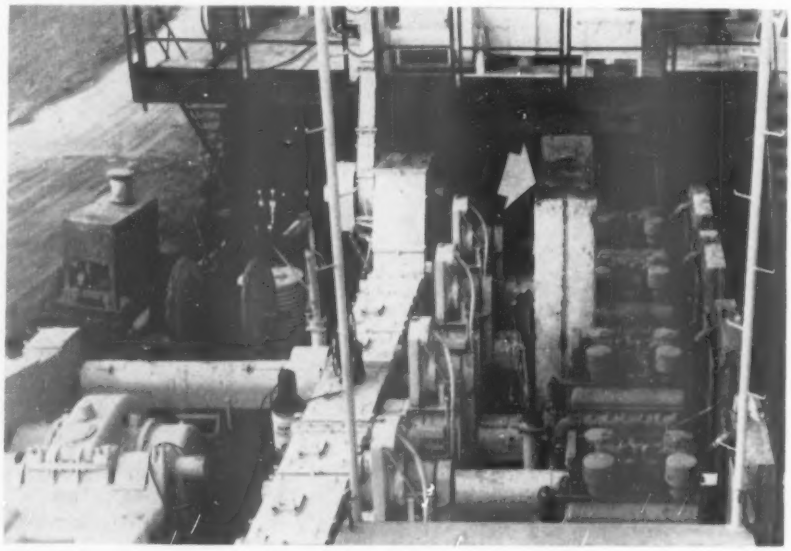
BILLINGS, Mont.—Flank Oil Co. was high bidder on two tracts of government-owned land near Oilmont, Mont., with an offer of $14,220 for an oil and gas lease on the 100 acres at a bureau of land management lease sale.

Hunter Co., Shreveport, La., submitted the high bid of $3,110 for a 220-acre parcel in the same area in the Kevin-Sunburst field.

New Refinery Planned

MINOT, N. D.—Dakota Oil & Refining Co., headed by Robert D. Tenison, Billings, Mont., is planning construction of a 2,500-bbl. refinery here.

It is understood the company as yet has been unable to obtain long-term commitments of crude and that financing arrangements are not completed.



Shell Tries Exhaust Stack for Safer Operation

Four drilling engines feed exhaust gases to a common stack on a new Shell Oil Co. rig now operating in Brea Canyon field in California. The four engines and the exhaust manifolding are unitized into a package skid unit. The exhaust system consists of four 8-in. lines and the common stack, shown by arrow. The arrangement is designed to lessen the danger of ignition of escaping well gases.

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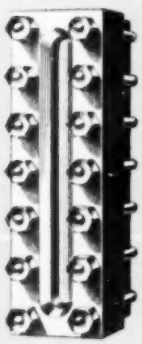
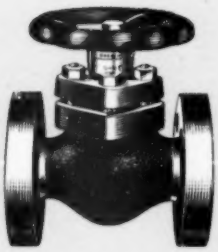


VALVES



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Texas Tests Market

Big Texas allowable boost fails to trigger production race as Oklahoma and Louisiana do not add big increases

AUSTIN.—Fear expressed by many oil men that the big 151,968-bbl.-daily boost in the Texas crude production allowable for March would ignite an open fight between prorating states for the domestic crude market appeared unfounded last week, at least for another month.

Such misgivings were eased when Louisiana raised its allowable only 16,195 bbl. daily to 669,845 bbl. to take care of new production, and Oklahoma left permissible production unchanged at 525,000 bbl. daily.

The coming hike in Texas oil output, looked on in some quarters as a Texas Railroad Commission move to test the market, was based primarily on two factors:

...Crude stocks declined substantially during February both in Texas and over the nation.

...Texas is producing considerably less of the national daily crude requirement than is justified by its percentage of the total national reserve, according to Railroad Commission Chairman E. O. Thompson.

The March allowable, based on 18 days production over the state generally and in East Texas field, was set at 2,982,416 bbl. daily, as compared with an initial figure of 2,830,448 for February.

Stocks . . . Thompson said Texas crude stocks were reduced 324,142 bbl. daily during the week ended February 6, while at the same time domestic crude stocks over the nation were down 338,856 bbl. daily. Thus, he said, Texas accounted for all but about 15,000 bbl. of the national stocks reduction. He noted that stocks of foreign crude increased 79,000 bbl. to a total of 10,742,000 bbl. during the same period.

On the other hand, as Thompson put it, "we are long on gasoline — very long."

"Gasoline stocks," he said, "stand at 171,972,000 bbl., which is 19,479,000 bbl. above the stocks of a year ago this date." With the buildup in gasoline stocks expected between now and April 1, the surplus will be considerable unless the refiners of the nation show some restraint.

Reserves argument . . . Texas reserves, of crude Thompson said, comprise 51.7 per cent of the total reserves of the United States, while Texas crude production is running at about 42 per cent of total national output.

This compares, he said, with the following reserves and production figures for other states: Kansas, reserves 3.41 per cent of national total, production 4.59 per cent of total; Oklahoma, reserves 6.7 per cent, production 8.55 per cent; Louisiana, reserves 8.4 per cent, production 10.26 per cent; New Mexico, reserves 2.7 per cent, production 3.17 per cent; California, reserves 14.3 per cent, production 16.30 per cent; Wyoming, reserves 4 per cent; production 3.87 per cent; all other producing states, reserves 8.5 per cent, production 11.01 per cent.

Nominations . . . The 18-day pattern was requested by Magnolia Petroleum Co. and Sinclair Refining Co. Sun Oil Co. and Shell Oil Co. asked for a 19-day pattern over the state, the latter testifying that it would be about 5,000 bbl. of crude daily short even with this schedule.

Six firms, Humble Oil & Refining Co., Continental Oil Co., The Texas Co., Atlantic Refining Co., Tide Water Associated Oil Co., and Stanolind Oil Purchasing Co., asked for a 17-day schedule, while Gulf Oil Corp. nominated 18 days of the state generally and 17 for East Texas field. Stanolind's Ralph Dietler strongly urged that the 17-day pattern be adopted due to the normal seasonal drop in refinery throughput in March, he said.

ALLOWABLES BY DISTRICTS
(Barrels per calendar day)

	March	February 6	Increase
Dist. 1	47,902	46,279	1,623
Dist. 2	149,391	138,401	10,990
Dist. 3	455,204	429,460	25,744
Dist. 4	264,624	249,175	15,449
Dist. 5	49,919	47,619	2,300
Dist. 6 (Outside East Texas)	125,525	116,062	9,463
Dist. 6 (East Texas field)	245,065	228,790	16,275
Dist. 7-B	164,391	155,315	9,076
Dist. 7-C	212,537	197,126	15,411
Dist. 8	908,450	855,493	52,957
Dist. 9	251,194	240,558	10,636
Dist. 10	108,214	107,398	816
Total	2,982,416	2,811,676	170,740

Tax Hike Opposed

Two associations announce resistance to any increases

MIDLAND, Tex.—Permian basin oil operators were told here last week to resist any additional tax increases on oil and gas.

Speaking at the first of a series of regional meetings of the Texas Mid-Continent Oil and Gas Association, Harry Bass, T.M.O.G.A. president and head of Harry Bass Drilling Co., Dallas, said Texas already collects more taxes from natural resources than all other states combined.

Oil and gas producers, he said, pay 95 per cent of these natural-resource taxes.

Tax-increase proposals now being circulated, Bass said, are designed to generate more money for state schools. The cause is worthy, he said, but others should match oil's present contribution. At present, 46 per cent of every dollar spent for education comes from the oil industry, he declared.

TIPRO also opposed . . . Another blast against increased taxes came last week from M. D. Bryant, president of the Texas Independent Producers and Royalty Owners Association in Austin.

Both the executive committee and the membership will stand firm, he said, on their contention that producers and royalty owners already pay more than their share of state taxes. There is a need, he added, for a basic revision of Texas' tax structure to include other industries.

Gas-Tax Rehearing Asked

AUSTIN.—Texas Atty. Gen. John Shepperd has petitioned the United States Supreme Court for a rehearing of the natural-gas-gathering tax case.

The tax was ruled unconstitutional by the court February 8 *(The Oil and Gas Journal, February 15, page 92)*.

Shepperd argued in the petition that the court misunderstood the situation when it reversed an appeals court ruling in favor of the state on grounds that the tax interferred with interstate commerce. The taking of gas by pipe lines for delivery outside the state actually is part of the same, he said, and therefore taxable.

If the Supreme Court refuses to rehear the case, the Texas treasury must refund about $25,000,000 in tax payments to companies which protested the tax.

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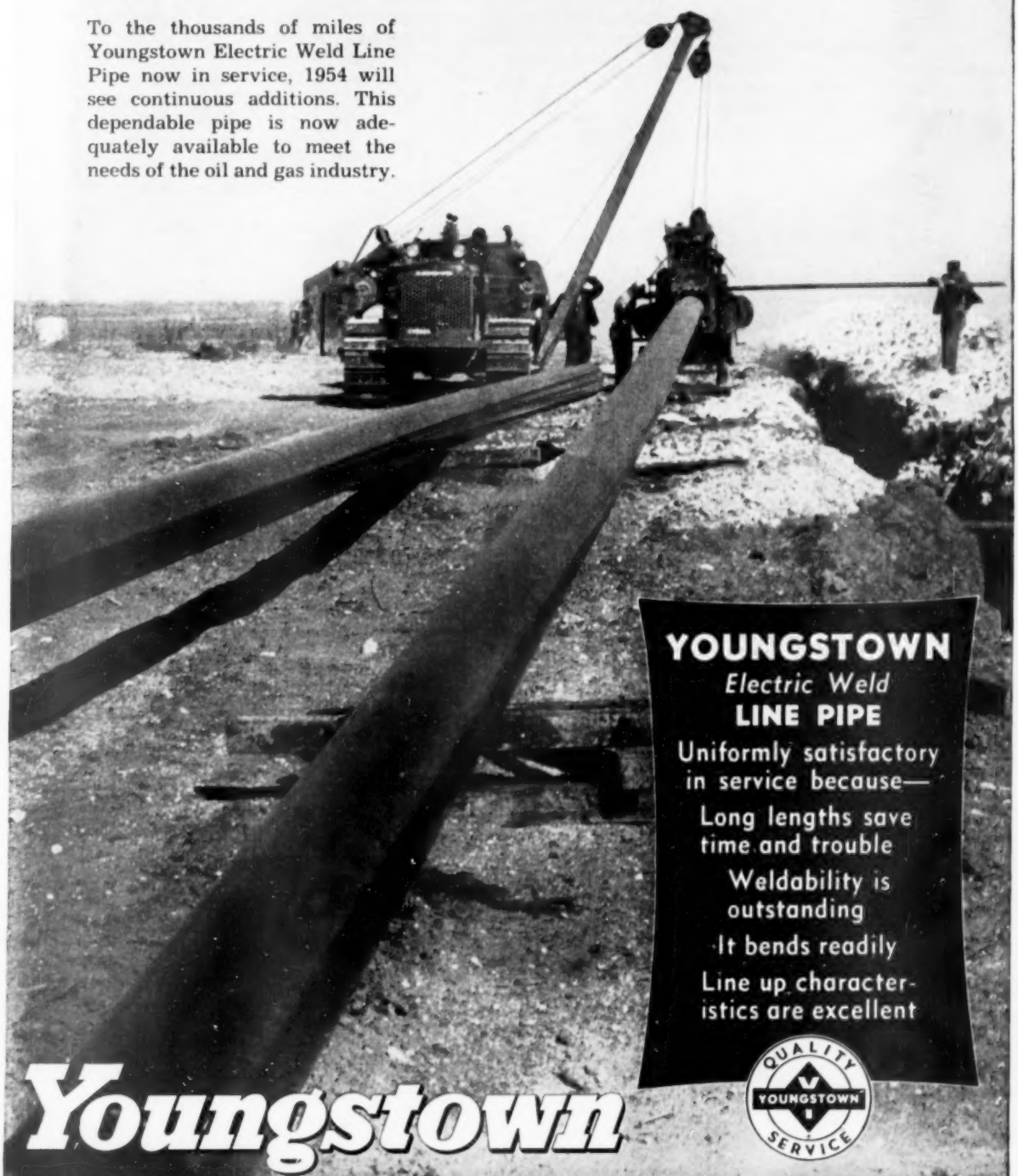

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GULF COAST

New Gas Discovery

Louisiana gas-condensate well may mark new field

HOUMA, La. — Discovery of what appears to be another important gas-condensate field, located 5 miles west of here in northern Terrebonne Parish, has been announced by Arkansas Fuel Oil Corp., of Shreveport, and John Mecom, of Houston.

The discovery well is the 2 Southdown Sugars, Inc., which tested 6,000,000 cu. ft. of gas daily, flowing through ¼-in. choke on the tubing with 4,700-psi. pressure. Shut-in pressure gaged 4,900 psi. The gas showed a substantial condensate content, but no gage of the liquid hydrocarbons was made on the preliminary tests.

Production is from a perforated interval at 11,316-26 ft. in Miocene sand. The hole had been drilled to 12,161 ft.

Location is on a 4,650-acre lease block held by the Shreveport company, which will operate the property. Drilling of the well was under the direction of Mecom, who also has extensive holdings in the area.

May be extension . . . It is possible the discovery may prove to be a major extension of deep, high-pressure gas-condensate production in Hollywood field, 2¾ miles to the east, opened early last year by Tide Water Associated Oil Co.

Hollywood, with indications of becoming one of South Louisiana's larger and more important gas-condensate-producing fields, has four completed wells to date, three by Tide Water and one by Mecom, whose acreage adjoins Tide Water's properties and extends to the Arkansas Fuel Oil Corp. block. Production in that field, now spreads more than 2 miles in length, is from multiple sand zones ranging in depth from 12,400 ft. to below 14,400 ft.

Five miles west of the new discovery is the much older Gibson field, where important oil and gas production has been developed. The general area extending from this field through Hollywood to Houma, and Houma gas field, adjoining the townsite, has been the scene of extensive exploration and development during the past year.

Engineers' Fees Go Up

WASHINGTON. — Oil companies operating on the submerged lands, both within and beyond state boundaries, will hereafter be required to pay fees for permits granted by the Corps of Engineers to work in navigable waters.

In the past such permits have been issued without charge, but under legislation enacted in 1952 all federal agencies are required to recover, by fees and charges, the cost of services rendered to individuals and organizations.

A schedule of charges to be imposed beginning in April carries a fee of $175 for permits to build "structures not used in waterborne commerce and navigation," including oil wells. A fee of 50 per cent of the original charge will be imposed for revised plans and extensions of time.

Louisiana Production Up

BATON ROUGE, La.—Gross oil production in Louisiana during 1953 totaled 263,449,124 bbl. compared with 250,038,830 the previous year.

The state conservation department's "final official audited" 1953 production figures with 1952 figures in parenthesis are: crude oil, 238,228,874 bbl. (227,864,532 bbl.); condensate, 24,220,733 bbl. (22,174,298 bbl.) casinghead gas, 274,599,239,000 cu. ft. (252,004,141,000 cu. ft.); and natural gas, 1,125,141,476,000 cu. ft. (1,032,335,649,000 cu. ft.)

MID-CONTINENT

Oil Play Nears City Limits

HOLDENVILLE, Okla. — Grief Creek pool development is nearing the city limits of this east-central Oklahoma town and is causing considerable excitement.

The newest Booch sand well to be tested, and also nearest the town, is E. E. Majors 1 Majors in the SE NE NE 17-7n-9e. The well flowed 85 bbl. of oil per hour natural.

Holdenville city officials have announced specifications which must be met for city drilling. The first application to drill inside the city limits has been filed by Guy M. Buchner.

Kansas Invites Rule Changes

WICHITA, Kans.—The Kansas Corporation Commission has asked oil industry representatives to recommend changes in the general rules and regulations for conservation in Kansas.

The invitation was issued by Jeff Robertson, chairman, who asked that any such recommendations be mailed to the commission at Topeka and a copy sent Theo. A. Morgan, conservation director, at Wichita.

Oklahoma Petrochem Plant Nearing Completion

Deere & Co., a newcomer in the petrochemical field, is building this $18,000,000 nitrogen chemicals plant at Pryor, Okla. The plant, scheduled for completion before midyear, will process about 5,000,000 cu. ft. per day of natural gas, obtained from Oklahoma Natural Gas Co. Partial oxidation units (Texaco Development Co.) will be used to prepare hydrogen from the natural gas. Design daily capacity is 180 tons of ammonia and 275 tons of urea. Ammonia will be made by the Casale process at about 12,000 psi. and urea by the Pechiney process. Foster Wheeler Corp. is contractor for the project.

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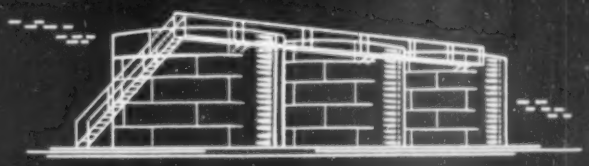

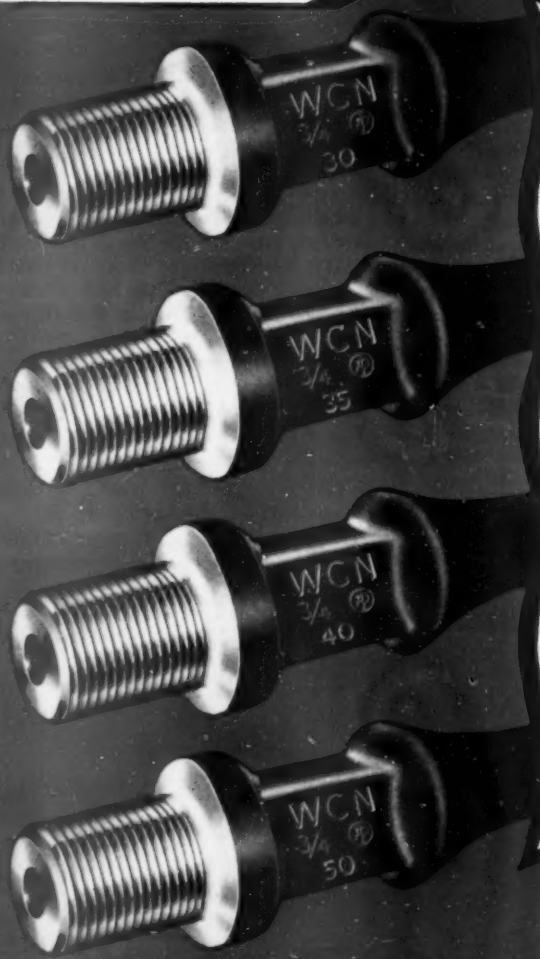

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Oil Aids Middle East

Increased oil revenue being utilized to furnish internal improvements of varied kinds in oil-producing countries

GOVERNMENTS of the oil-producing countries of the Middle East are moving ahead with large-scale projects for internal development which have been made possible by greatly increased oil revenue.

The Development Board of Iraq, to which most of the country's oil income is assigned by law, has engaged a British firm to undertake the first stage of a comprehensive survey of Iraq's mineral resources of all kinds. The first stage involves collection and analysis of existing geological records and data, and the second stage, for which bids will later be called, will consist of field geological examinations and reports.

A recent announcement of the Iraq Ministry of Development said government is anxious to engage the services of qualified consulting engineering firms experienced in a number of fields, including petroleum products, process industries, and chemical operations. These firms would draw up approved projects and supervise contracting companies carrying them out.

In 1953, the Iraq Government received more than £51,000,000 ($143,000,000) from Iraq Petroleum Co., Ltd., and its associated companies under terms of the 50-50 profit sharing agreement signed in 1951. When the agreement was signed, it was expected that the government's 1953 income would amount to £45,000,000, but crude-oil production on which the revenue is based has risen more rapidly than anticipated. Some 70 per cent of the total oil income is flowing into a variety of internal-improvement projects, including sanitation, education, and water resources.

Kuwait . . . The Development Board of Kuwait has chosen a British engineering company to act as consultant in connection with one of its most important oil-financed projects—the transportation of large quantities of fresh water to Kuwait from the Shatt-el-Arab River in Iraq.

The project is to be carried out in three stages: one, pipe-line transportation of 30,000,000 gal. of fresh water from the Shatt-el-Arab daily, mainly for domestic use; two, increasing the supply to 70,000,000 gal. daily with use to include limited irrigation; and three, investigation of the possibilities of a larger plan for a water canal.

Like Iraq, Kuwait produces sterling oil, and its income is received in that currency. The Kuwait announcement said that if possible all requirements for the Shatt-el-Arab project would be purchased within the sterling area. The British engineering firm will do the necessary survey work, prepare designs and contract documents, and supervise construction.

Kuwait, now the world's fourth oil-producing country, is almost without fresh-water supplies. Some brackish water is obtained from wells, and both the government and Kuwait Oil Co., Ltd., have built expensive sea-water distillation plants. For many years, fresh water was brought in Arab sailing craft from the Shatt-el-Arab.

Saudi Arabia . . . The Saudi Arabian Government is reported to be studying possible ways to utilize waste gas now produced with crude oil by Arabian American Oil Co. Saudi Arabian officials in Washington have recently been discussing the problem with American consultants and advisers. Utilization in petrochemical manufacture is one outlet under consideration. Several weeks ago, Saudi Arabian representatives in this country advertised for bids for an ammonia and dry ice plant which would make limited use of now-flared gas.

New "Largest" Tankers Set

Orders for two tankers substantially larger than the 45,130-ton vessel launched recently in the United States have been placed with Vickers-Armstrong, Ltd., in England by Stavros Niarchos, Greek shipowner.

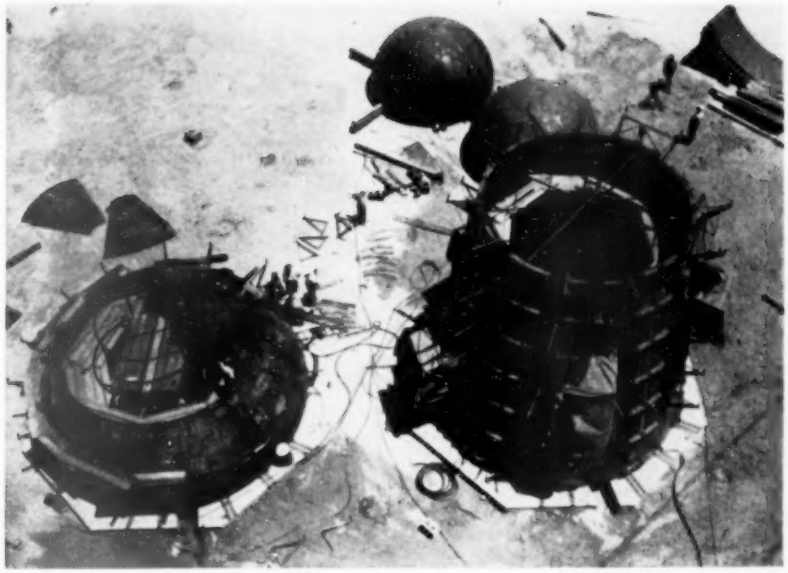
The plans for these tankers, which when built will be the world's largest, were disclosed by Niarchos following the launching in England of the 33,000-ton World Harmony, another new vessel for the Niarchos fleet.

Niarchos said he had ordered the large ships because they meant cheaper running costs and a quicker turn-around in port. The 45,130-ton tanker recently launched for him in the United States was the World Glory, at present the world's largest on the basis of carrying capacity (*The Oil and Gas Journal, February 15, page 98*).

Niarchos's new vessel in England, the World Harmony, will be used in the Persian Gulf-United Kingdom trade. She will be able to carry more than 238,000 bbl. in comparison to approximately 393,000 bbl. in the World Glory.

Amuay Ships One-Quarter of Venezuela Oil

One of the major shipping points for Venezuelan crude and products in the Amuay terminal of Creole Petroleum Corp. on Paraguana Peninsula. It is adjacent to the company Amuay refinery now being doubled to 120,000 bbl. daily capacity. Of the 100,402,990 bbl. of crude shipped from Venezuela to the United States from January through October of last year, 23,280,993 bbl. came through Amuay, including 17,361,816 bbl. of above 25° gravity, and 5,919,177 bbl. of heavy oil.



SECTIONS of the 120-ft. reactor-regenerator of the catalytic cracker being assembled on the site of the Kwinana refinery (Anglo-Iranian photo).

Big Kwinana Refinery Going Up

PROGRESS is being made on construction of Anglo-Iranian Oil Co., Ltd.'s 70,000-bbl. daily Kwinana refinery, largest of four new refinery projects under way in Australia.

The refinery, situated near Fremantle in West Australia, is scheduled to come on stream in mid-1955. Facilities include the two crude units, 24,000-bbl. daily vacuum distillation, 10,000-bbl. daily fluid catalytic cracking, and 6,000-bbl. daily Platforming units.

Orders for nearly $28,000,000 in equipment and materials have been placed with British, Australian, and American manufacturers in addition to subcontracts with Australian firms for preparatory and site work equivalent to more than $2,800,000. Orders with British manufacturers exceed $6,700,000, while the total placed thus far in Australia amounts to about $9,800,000.

Work has commenced on the erection of storage tanks and all refinery units. Some of the plants, including the catalytic cracking unit, are well advanced. The three-berth jetty is about one-quarter completed, and 3,500,000 cu. yd. of material or half the amount estimated has been dredged from the entrance to Cockburn Sound in the work on a channel to be 38 ft. deep and 500 ft. wide.

INTERIOR view of one of the two crude distillation units under construction for the new Kwinana refinery (Anglo-Iranian photo).

Coal-to-Oil Cost Up

South Africa project cost estimated at $89,000,000

THE total cost of South Africa's coal-to-oil plant, scheduled to start production sometime this year, has risen sharply to an estimated £31,800,000 of the equivalent of about $89,000,000.

The latest estimate was given by F. J. du Toit, chairman of South African Coal, Oil & Gas Corp., Ltd., at the recent third annual meeting of the firm. The SASOL chairman attributed the sharply increased estimate to three major things:

. . . **Expansion in capacity** to 71,000,000 gal. per year (about 5,550 bbl. daily) from the original plan for 55,000,000 gal. per year (about 4,300 bbl. daily).

. . . **Necessity to process byproducts** to a further stage so they can be marketed locally.

. . . **Increased manufacturing costs** in Germany where most of the equipment has been purchased.

Discussions have been carried out with five oil marketing companies in South Africa, and it is expected that more than half the SASOL gasoline will be produced to specifications of these companies and sold to them. The remainder, consisting of a high quality blend, together with most of the solvents and other chemicals, would be disposed of by the SASOL marketing company. When the plant starts production, industrial waxes of several types will be among the byproducts.

SASOL is a government corporation set up in September 1950 which took over the rights, patents, and options of Anglo-Transvaal Consolidated Investment Co., Ltd. Anglo-Transvaal had begun studies of a possible oil-from-coal operation in South Africa as early as 1935.

The complete plant on which construction was begun in mid-1952 under supervision of M. W. Kellogg Co. is situated on a site of 5,000 acres at Coalbrook in the Orange Free State about 40 miles south of Johannesburg. Originally it was estimated the installation would cost about £13,000,000, or around $36,400,000. Subsequent estimates increased to £25,000,000, and are now £31,800,000.

The present estimate, equivalent to $89,000,000, represents an outlay of about $16,000 per barrel daily of production. However, output will include a variety of chemicals as well as motor fuel, gas oil and fuel oil.

The economics of the project is largely predicated on the availability of low-cost coal. The Vaal River provides

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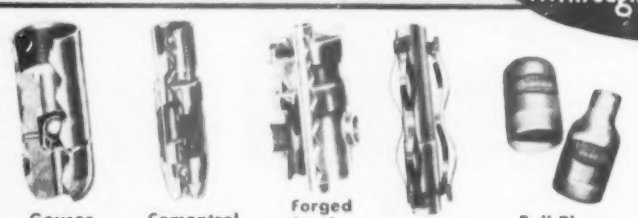

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ample supplies of water, while the mineral resources of the area provide nearly 700,000,000 tons of low-grade accessible coal. Mechanical mining methods are expected to produce coal at around 6s, or about 84 cents, a ton. The mine in connection with the project is able to draw from three seams with first development scheduled for the middle seam which averages 24 ft. in thickness.

The coal is processed initially in nine Lurgi synthesis gas generators with a combined output of nearly 4,500,000 cu. ft. an hour. The gas is processed either in a Kellogg plant with moving bed, or in Lurgi fixed-bed reactors. The Lurgi reactors have about one-third the capacity of the Kellogg plant.

Immediate byproducts of gasification include benzole, xylene, and toluene, crude tar acids and creosote, and the raw material for the production of ammonium sulfate for fertilizers. Byproducts of the Fisher-Tropsch processes include alcohols, acetone, and methyl ethyl ketone. About 1,000 tons of L.P.G. will be produced annually, and fuel gas may also be moved by pipe line to the industries of southern Transvaal.

Active Rigs Increasing Indonesia Output

Despite its troubled political situation, Indonesia remains the largest producing country in the Far East with current output exceeding 200,000 bbl. daily. Of the more than 20 rigs operating in Indonesia, about half are active in the South Sumatra fields of Standard-Vacuum and Royal Dutch-Shell. The view here is of a Standard-Vacuum steam rig in South Sumatra.

Wafra Clamp Lifted

Saudi Arabia delays order halting crude-oil movement

A SAUDI ARABIAN edict prohibiting Pacific Western Oil Co. from moving oil from the Neutral Zone has been suspended for 6 months.

The order was issued as a result of movements of Pacific Western's share of Neutral Zone production through American Independent Oil Co.'s line to a tanker-loading terminal in Kuwait. Terms of Pacific Western's concession from Saudi Arabia provide that any oil must be shipped within Saudi Arabian borders.

The edict caused cancellation of scheduled tanker liftings and diversion of tankers en route to Kuwait to other destinations.

Last week, however, a tanker was on the way to the Kuwait port to pick up a shipment for Pacific Western, and J. Paul Getty, Pacific Western president, was en route to Saudi Arabia to discuss the future of Neutral Zone production with Saudi Arabian officials.

Delay in enforcement of the edict followed by a week the disclosure of a tanker pact between Saudi Arabia and Greek shipowner A. S. Onassis which could result in greatly increased costs for Middle East operators *(The Oil and Gas Journal, February 22, page 126)*.

There were indications that Saudi Arabia may require construction of a pipe line and an offshore-loading terminal by Pacific Western either within the Neutral Zone or in Saudi Arabia. Until the shutdown order, Pacific Western had been paying Aminoil a per-barrel shipping charge for moving its crude to the Kuwait terminal.

Even with the order suspended, it appeared last week that the volume of Wafra field production might be limited for some time by lack of market outlets. One source last week said buyers had not yet been found for all of the field's production.

Egyptian Deal Made

Government, majors sign exploratory agreement

ANGLO-EGYPTIAN OILFIELDS, LTD. (Royal Dutch-Shell) and Socony-Vacuum Oil Co., Inc., are reported to have reached an agreement with the Egyptian Government under which exploratory operations by these two major operators may be resumed.

The two companies filed on a number of exploration permit areas of 50,000 hectares each (about 125,000 acres) in 1948 and earlier. The government subsequently cancelled these applications under protests from the companies.

Full details of the new agreement, which was to be formally signed in Cairo last week, were not available. It was understood the reinstatement of the exploration applications would be a part of an over-all agreement dealing principally with prices of products sold on the domestic market. The pricing question has long been a major point of difference between the companies and the government.

Socony-Vacuum and A.E.O. are the only present producers in Egypt, although their activites have been completely confined to operating existing fields for about 2 years. The two companies operate jointly over most of the Sinai Peninsula, and in addition, Socony-Vacuum has exploratory permits in the region west of the Gulf of Suez.

Well tested . . . Another development in Egypt was the testing of oil in the Feiran 2 well being drilled by Southern California Petroleum Corp. as operator for the International Egyptian Oil Co., Inc. The well, located about 3,000 ft. west and south of Feiran 1, was reported to have tested an estimated 2,500 bbl. daily from the Miocene from 6,825-6,827 ft. Gravity of the crude was 23° A.P.I.

Iran Tour Completed

Mission returns to London to make investment report

A TWENTY-MAN technical mission representing eight major international oil companies has returned to London from a week's inspection trip of Anglo-Iranian Oil Co., Ltd.'s nationalized properties in southern Iran.

The group's visit was the latest step in the slow and cautious progress being made toward a settlement of the long-standing dispute. It was the first time representatives of Anglo-Iranian or other major foreign oil companies have entered the concession area since the expulsion of the British staff in September 1951.

Members of the inspection team were scheduled to submit a full report on their trip at a meeting of the companies in London. The report also was to be made available to the Iranian Government.

Purpose . . . Main purpose of the inspection was to determine the investment that will be needed to resume production in the fields and at Abadan. Officials of the eight companies have been holding meetings in London since early January working out details of an international consortium which will market Iranian oil and assist with the operations.

Representatives of the five American companies on the inspection team were: D. I. Maxwell and James Clark, Standard Oil Co. (N.J.); F. C. Fahnestock and C. H. Moon, Socony-Vacuum Oil Co., Inc.; H. J. Hawley, Standard Oil Co. of California; H. M. Cash and H. B. Peters, The Texas Co.; and L. J. Lashley and G. W. Knight, Gulf Oil Corp. The remaining members of the group represented Anglo-Iranian, Royal Dutch-Shell, and Cie. Francaise des Petroles.

On the group's return to London, Clark said: "We visited each of the oil fields in turn. They appeared to have been maintained expertly by the local skeleton staff. Everything is in good running order." P. Cox, chief geologist for Anglo-Iranian and another member of the mission, said the survey had been "most worthwhile."

Although the detailed conclusions of the company inspection group had not yet been formulated, a preliminary estimate attributed to Herbert Hoover, Jr., the State Department's special Iranian oil adviser, was that $70,000,000 to $75,000,000 would be needed to get the operation going, not counting probably an equal amount in working capital and advances to the Iranian Government.

The National Iranian Oil Co. has estimated a much lower figure of $30,000,000 to $40,000,000, but Dr. Reza Fallah, N.I.O.C. director, recently explained this covered only direct refining equipment and not such auxiliary items as the badly deteriorated motor transport.

Although the N.I.O.C. has carried out a regular maintenance program, corrosion has taken its toll over the last 2½ years, and there has been an almost complete lack of usual replacements. Of course, it is recognized the final investment will depend largely on the rate at which the facilities are operated.

Next move . . . The likely next move in the settlement effort was indicated recently by the new British ambassador to Iran, Sir Roger Stevens. On his arrival in the Iranian capital he said a mission to conduct oil talks with the Iranian Government is due in Teheran in the near future.

It was reported in Teheran that Torkild (Cap) Rieber, who is serving as special oil adviser to the Iranian Government, had left for 2 weeks in the United States. Another development was the appointment of Khalil Kazeruni, formerly staff manager of the Abadan refinery, as administrative director-general of the National Iranian Oil Co. Kazeruni, a former Anglo-Iranian employe, was dismissed during the Mossadegh regime for "loyalty to Anglo-Iranian."

International Briefs

Communist China claims that more than 100 wells were drilled last year in the northwestern and southwestern parts of the country by "prospecting teams," according to the China News Agency. Twice as many teams and drilling rigs were operating as in 1952, and total footage was 32,000 ft. greater than the previous year.

Creole Petroleum Corp.'s Tia Juana-187 well in the lake area of western Venezuela has been capped. The well blew out recently during a routine workover when the crew uncoupled surface connections preparatory to pulling tubing and running a new packer. It continued out of control for 6 days but without injuries or fire, and was capped with the assistance of Paul Adair, who was flown in from Tulsa. TJ-187 was completed 13 years ago, has produced over 5,000,000 bbl. of oil and had been flowing about at a rate of 2,500 bbl. daily prior to the blowout.

Union Oil Co. of California's Paita 2 test in the Sechura Desert has been abandoned. The hole hit basement at a depth of 1,282 ft. 15 days after drilling started. The unexpected result was said to show a complete failure of previous geophysical information, including seismograph. The National 130 rig belongs to International Petroleum Co., Ltd., which is expected to use it for a second Sechura test in the near future. Industry reports are that Richmond's Inca 5 in the southern Sechura section has been abandoned with no shows at below 6,000 ft. This marks the third unsuccessful test in the Sechura, including the International Viru well. Although these specific localities have been condemned, many other areas remain to be tested. International is expected to drill its second Sechura test a few kilometers northwest of Puira on Seaoil acreage in which it has a 50 per cent interest.

The six continental refineries of Anglo-Iranian Oil Co., Ltd., last year increased their throughput to around 8,000,000 tons (160,000 bbl. daily), a gain of more than 500,000 tons (10,000 bbl. daily) over the previous year. The refineries in which A.I.O.C. is interested consist of two in France, two in Germany, and one each in Belgium and Italy. Highest throughput of the six was at the Lavera refinery near Marseilles in France where 2,210,000 tons, or about 44,000 bbl. daily were processed. Anglo-Iranian announced earlier its refineries in Britain last year handled an average of about 184,500 bbl. daily, up 26.4 per cent over the previous year.

The Royal Dutch-Shell Group is studying the possibility of petrochemical operations in Japan, according to a report from London. A program to develop a domestic petrochemical industry in Japan would be undertaken under agreements with Japanese oil companies. Japan now has a refining capacity of about 125,000 bbl. daily, and domestic petroleum consumption is expanding rapidly. Shell now is joined in a sales and refining agreement with Showa Oil Co. which has around 21,000 bbl. daily refining capacity in three plants.

Production of 11,000,000 lb. annually of Terylene, or Dacron, will be started by Imperial Chemical Industries early next year with the completion of a $56,000,000 plant at Wilton, England, on which work was started in July 1952.

Iranian Oil Adviser

"Cap" Rieber's oil industry experience spans 50 years

SOME of "Cap" Rieber's friends were mildly surprised several weeks ago when he was invited to return to Iran as an adviser to the Iranian Government.

This was because of Torkild Rieber's rather well-known trait of saying what he thinks, and according to all reports in the industry, when he visited Iran in January 1952 as a consultant to the World Bank, he minced no words in telling the Iranians some of the hard truths of the world oil business and not what they probably wanted to hear.

The fact that the Iranians asked for Rieber to come back and give them assistance is, his friends say, a tribute to his sincerity and his thorough knowledge of the petroleum industry in all its ramifications.

Rieber returned to Iran at the request of the Iranian Government and with the approval of officials in Washington and London. He is looked on as playing an important role and one whose statements can be accepted with complete confidence.

Career covers 50 years . . . Whatever contribution Rieber makes in any final settlement of the Iranian dispute would come as a climax to a long and colorful career in the petroleum industry. He is one of the few executives still active whose service reaches back to the early days of the Spindletop boom which opened up the Gulf Coast in 1901.

Rieber still speaks with a slight trace of an accent which betrays the fact that he was born in Voss, Norway, 72 years ago this March. He was educated in high school and a marine academy in Norway and went to sea in 1897 at the age of 15. In the next few years, he served on both steam and sailing vessels.

Marine transportation became the route through which he entered the oil business. He was mate on one of the first tankers to load Spindletop crude, and in July 1905, he joined The Texas Co. when it purchased the tanker on which he was serving. The company had been organized only 3 years earlier, and Rieber became chief officer of a company tanker. He was naturalized an American citizen in 1905.

He took up shore duties in 1909 and for the next 10 years served in marine and refining departments of the fast-growing Texas company in various capacities. The nickname "Cap" from his seafaring days stayed with him. In 1919, he left The Texas Co. to go with J. S. Cullinan. Cullinan, considered the founder of The Texas Co., had resigned in 1913.

Texas Co. chairman . . . He returned to The Texas Co. in 1927 and took charge of the export and marine departments. The following year, he became a vice president and a director. In 1935, following the death of Judge C. B. Ames, he was elected chairman of the board. During his 5 years in this position, Rieber guided the company in its major expansion abroad.

Shortly after the war in Europe broke out, Rieber was able to take delivery on some tankers which had been built in Europe using blocked currency from oil sales. The deal was approved by the British who thus chartered two of the company tankers. However, it touched off a public controversy, and Rieber resigned to avoid hurting the company. Since then, he has been gun-shy of the press. An interesting footnote to this incident was in the fact that later in the war he organized a shipyard at Charleston which built vessels for the Allies.

Since 1942, Rieber has been president of Barber Oil Corp. (formerly Barber Asphalt Corp.). During the last 14 years, he has built this company up to a prosperous, money-making operation. He sold off the losing properties, stepped up exploratory work, and bought tankers. By stock purchases beginning in 1946, Rieber bought control of American Republics Corp. which he had headed in 1926 while working for Cullinan. He now serves as board chairman.

Daryl Hopkins, geologist with Amerada Petroleum Corp., has been transferred from Dickinson to Williston, N. D.

Max Bailey, with Frank Wood & Associates, has been promoted from driller at Knox City, Tex., to tool pusher at Hamlin, Tex.

Hayward H. Hill, formerly petroleum engineer with Stanolind Oil & Gas Co. at Fort Worth, has joined Sinclair Oil & Gas Co. as logging engineer at Tulsa.

Floyd Acklin, Jr., geologist with Richardson & Bass, has been transferred from Fort Worth to Carlsbad, N. M.

Neville B. Dortch, driller, formerly with Miami Operating Co., has joined D. H. & H. B. Drilling Co., at Abilene, Tex.

M. T. Hamilton has been appointed safety superintendent of the manufacturing department of General Petroleum Corp.'s refinery at Ferndale, Wash. He replaces **Mark H. Milam,** who has been appointed manager of industrial relations at Ferndale. Hamilton has been fire and safety supervisor of General Petroleum's refinery at Torrance, Calif., since 1950.

Julius O. Fifer has been appointed vice president and director of Caltex (Philippines), Inc., which is now constructing a new refinery at Batangas, south of Manila. Fifer, whose headquarters will be in the Philippines, formerly was assistant general manager in Bahrain for Bahrain Petroleum Co., Ltd., a member of the Caltex group.

R. E. (Dick) Duty, consulting petroleum geologist, has moved his offices from Mount Vernon, Ill., to Denver. He was previously with W. C. McBride, Inc., for more than 12 years as district geologist of Oklahoma, Kansas, and North Texas.

E. B. Haylum, Jr., geologist formerly with General Petroleum Corp. in Salt Lake City, has been made district geologist at Casper, Wyo., for Pubco Development, Inc., wholly owned subsid-

iary of Public Service Co. of New Mexico. **Henry Krusekopf,** geologist formerly with Magnolia Petroleum Co., has been placed in charge of another new district covering southeast New Mexico and West Texas with headquarters in Roswell, N. M. **Bill Street,** geologist formerly with Pure Oil Co. at Durango, Colo., has been placed at Aztec, N. M., to handle the San Juan basin and expanded operations into Utah.

E. W. Lewis has been named assistant to the manager of The Texas Co.'s West Texas division with headquarters in Fort Worth. He formerly was division land man for the West Texas division in Fort Worth.

Phillips R. Becker has been named division geologist and manager of the West Texas-New Mexico division of Kerr-McGee Oil Industries, Inc., at Midland, Tex. Becker is being transferred from Kerr-McGee's headquarters office in Oklahoma City. He replaces **Louis B. Kellett,** who resigned recently to join Tide Water Associated Oil Co. at Midland as a geologist. **John Masters,** geologist, also has been transferred by Kerr-McGee from Oklahoma City to the Midland staff.

Andrew J. Betts has joined White Eagle Oil Co. as district geologist in Midland, Tex. Betts resigned as geologist with El Capitan Oil Co. in Midland. Prior to joining El Capitan, he worked for Skelly Oil Co. and Pure Oil Co. in Oklahoma, Texas, and New Mexico.

F. E. McFARLIN

Frank E. McFarlin, Ponca City, has been promoted by Continental Pipe Line Co. from assistant superintendent to superintendent of the firm's communications division. He succeeds **A. F. Harrel,** who has retired after 25 years with Continental. McFarlin had held his former post since joining the firm in 1952, and will now supervise the operations of 5,454 miles of telephone and teletype lines and 12 radio patrol and communication stations.

H. C. Rogers, formerly chief maintenance mechanic at Bishop, Tex., for Chicago Corp., has joined Goliad Corp. as plant foreman at Freer, Tex.

Grease Institute Directors Visit New Plant

Directors of the National Lubricating Grease Institute pause after arriving in Toronto before going on to Clarkson, Ont., to visit the new grease plant at the British American Oil Co., Ltd., refinery. Left to right: C. L. Johnson, Sunderland Grease & Oil Co.; G. A. Olsen, Sunderland Refining Corp. and president of the institute; Harry Bennetts, executive secretary of the institute; W. M. Murray, Deep Rock Oil Corp.; and A. J. Daniel, Battenfeld Grease & Oil Corp.

J. G. Blevins, Jr., field foreman for The Texas Co. at Hobbs, N. M., has been elected chairman of the Southeastern New Mexico chapter of the American Petroleum Institute, replacing **Paul S. Johnston,** Trinity Production Co. Other new officers are: **Ray Ely,** Cities Service Oil Co., first vice chairman; **Bill Randolph,** Continental Oil Co., second vice chairman; **Harold Massey,** Cities Service, third vice chairman; and **Alan Antwell,** Hobbs Pipe & Supply Co., secretary-treasurer.

Joe B. Hudson, acting area geologist in California for Humble Oil & Refining Co. during the last year, has been elected vice president in charge of exploration and production operations of Monterey Oil Co. He had been with Humble since 1934.

R. W. Cretney has been named vice president and general manager of Thermatomic Carbon Co., manufacturers of carbon black, succeeding **Clark Boardman,** who has retired after 32 years with company. Cretney has been with the firm since its founding in 1923. **S. S. Gill** has been advanced from plant engineer to manager of the plant at Sterlington, La.

Dr. James H. Gardner has been appointed assistant director of the petrochemicals department of National Research Corp., Cambridge, Mass. **Dr. Charles I. Tewksbury** has replaced him as project manager. Prior to joining National Research, which was formed to develop new processes for manufacturing organic chemicals and intermediates from natural gas, Dr. Gardner was a technologist in Shell Oil Co.'s Houston refinery.

Frank A. Nice, Jr., has joined Hurt Oil Co., Ltd., Houston, as manager of drilling and production operations. He formerly was associated with Texas Gulf Producing Co. as petroleum engineer in domestic and foreign operations.

Forrest W. Hood has been placed in charge of the geological department of Ohio Oil Co.'s new exploration offices in Tyler, Tex. The office supervises the firm's exploration activity in East Texas, formerly handled by the Shreveport division.

G. R. Brown, The Texas Co., has been elected president of the Petroleum Engineers Club of Fort Worth. **Jack Duree,** Pure Oil Co., was elected executive vice president; **R. G. Hiltz,** Stanolind Oil & Gas Co., first vice president and program chairman; **C. C. Bankhead,** Avila Oil Co., second vice president and entertainment chairman; and **Fred Woerner,** Texas Electric Service Co., secretary-treasurer.

George T. Naff, Herbert A. Hemphill, Vernon B. Chance, C. L. Brockschmidt, and **J. W. Hargrove** have been elected to the board of directors of Triangle Pipeline Co., recently pur-

PERSONALS

chased by Texas Eastern Production Corp., Houston. Chance is president of Triangle and the others also are officers and directors of either Texas Eastern Transmission Corp. or Texas Production.

Glenn Marrs has joined Toklan Royalty Corp., Tulsa, as assistant production superintendent. He formerly was chief production engineer for Cooperative Refinery Association, Kansas City. **William A. Bass, Jr.,** also has joined the firm as assistant geologist.

L. H. Huth has been appointed superintendent of the operating division of the Standard Oil Co. (Ind.) refinery now under construction at Mandan, N. D. As a supervisor in the projects division of Standard's manufacturing department in Chicago, Huth has overseen planning, preparation, and preliminary construction for the refinery.

John T. Haggin has been named to the newly created post of district representative for the Rocky Mountain area of the Independent Petroleum Association of America. He will be liaison representative for the organization throughout that area. His headquarters will be in Denver.

Gilbert M. Davies, with Pantepec Oil Co. and Venezuelan Atlantic Refining Co. for the last 10 years in Caracas, Venezuela, has joined Petroleum Industry Consultants, C.A., Caracas.

Archie H. J. Chadwick, Walnut Creek, Calif., has been promoted to assistant purchasing agent of Tide Water Associated Oil Co.'s western division, with headquarters in San Francisco. He succeeds **Alfred Urry,** who has retired after more than 40 years with the firm.

Elfried F. H. Pennekamp and **Harold J. Rose** have joined the staff of Standard Oil Development Co.'s new Enjay Laboratories division located at the Esso Research Center in Linden, N. J. Pennekamp, who was a section head in the firm's research division, is in charge of the sales technical service activities involving additives. Rose, formerly a section head in the Esso Laboratories of Esso Standard Oil Co. in Baton Rouge, La., is in charge of sales technical service work on alcohols and other chemicals.

L. McBain, Calgary, Alta., has been named by the Canadian Association of Oil Well Drilling Contractors as chairman of a committee concerned with safety activities in the industry and allied trades.

Harold G. Osborn, Ponca City, Okla., has been elected to the board of directors of Continental Oil Co. He has been vice president in charge of manufacturing since 1946, directing operation of eight refineries, development and research, petrochemicals and engineering departments. Osborn joined Continental in 1921 and also is an officer and director of several Continental subsidiaries.

Lewis D. Hedrick, Sr., has been promoted by National Cooperative Refinery Association, McPherson, Kans., from drilling superintendent to assistant general superintendent, with headquarters in Great Bend, Kans.

Richard B. Price, manager of the Socony-Vacuum Oil Co., Inc., refinery at Buffalo, N. Y., since 1946, has joined Standard-Vacuum Refining Co., Ltd., as managing director in charge of operations at its new refinery now under construction near Melbourne, Australia. Price will act as chief executive officer for the foreign company, a subsidiary of Standard-Vacuum Oil Co., Inc.

Byron O. Sims, Jr., petroleum engineer with Magnolia Petroleum Co., has been transferred from Healdton, Okla., to Seminole, Tex.

Lloyd E. Ugland has been named West Texas division manager at Midland by Louisiana Land & Exploration Co. Ugland formerly was a land man at Midland. **Daniel J. Miles** has been named division geologist, and **Glen L. Lewis** assistant division geologist, both at Midland. Ugland replaces **George B. McBride** who has been transferred to L. L. & E.'s headquarters office at New Orleans. Miles resigned recently from a position with Gulf Oil Corp.'s district geological department at Midland.

DEATHS

Warner B. Hagan, 61, pioneer Permian basin oil man, died February 19 in San Angelo, Tex. Hagan was active in the oil industry in Kansas, Oklahoma, and Texas. He organized Pecos Valley Pipe Line Co., now Comanche Pipe Line Co., and Pecos Valley Crude Oil Purchasing Co. in San Angelo, in 1926.

Whitmell B. Martin, 45, a partner in Martin & Ireland Oil Co., Wichita Falls, Tex., died in Wichita Falls February 23.

Robert A. Wilson, 73, president of Equipment Engineers, Inc., died February 23 in Dallas. He was a past national vice president of the rotary-drilling equipment section of the American Petroleum Institute.

Lew Fuston, 55, Strawn, Tex., drilling contractor, was killed in a dynamite explosion at a well on the Helen Watson ranch about 9 miles west of Palo Pinto, Tex.

Eduardo M. Buitron, one of the leading petroleum engineers of Petroleos Mexicanos, died recently in Tampico while on a refinery inspection trip.

Roy Ralph Rader, 76, retired driller, died February 22 in Tulsa.

C. F. Rittman, Jr., 48, superintendent of measurements for National Gas Co., El Paso, Tex., died recently in El Paso.

Dexter Allerton Cushman, 66, retired vice president of Fullerton Oil Co., Pasadena, Calif., died recently in Los Angeles.

Clifford Stewart, 61, vice president and chief chemical engineer of Faber Laboratories, Inc., died recently in Los Angeles following a heart attack.

James H. Smith, head of the communication division of the Los Angeles offices of Standard Oil Co. of California, died recently in Pasadena.

George W. Shaffer, 46, plant and field superintendent for S. P. Kinney Engineers, Inc., Carnegie, Pa., died recently.

Charles E. Maschal, 47, manager of Sun Oil Co.'s refinery at Marcus Hook, Pa., since 1951, died recently at Swarthmore, Pa., following a heart attack.

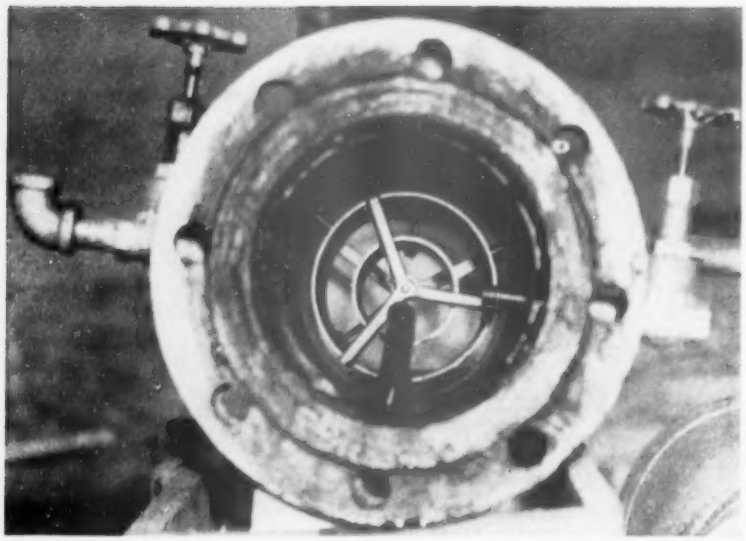

Fig. 1—Arrangement of probe spool in Gulf capacitance-type recorder for pipe lines.

Fig. 2—Typical installation for tests at field gathering station.

REPORT: Gulf's experiences with the

Capacitance Recorder in Pipe-Line Applications

Field tests indicate that it is here to stay

by J. D. Jones

THE recent development of a capacitance recorder holds promise of wide application in the solution of measurement problems in both the crude and products pipe-line industries. In crude-oil pipe lines, it has the ability to detect and record the presence and quantity of b. s. and w. within limits heretofore considered impossible in normal pipe-line practice. In products pipe lines, its ability to detect the product interface suggests wide use for that purpose alone. Its ultimate application and use appear most promising. From field tests to date the justifiable conclusion is that there is a definite place for the capacitance recorder in the pipe-line industry.

The instrument . . . The capacitance recorder was originally developed as an "automatic pipe-line gager" to shut down a pump in a pipe-line system should the water contamination exceed a predetermined percentage. Basically, it is an instrument in which activation is dependent upon a capacitance measurement between two electrodes; one arrangement of the electrodes is shown in Fig. 1. The dielectric of the condenser is the substance passing between the plates, being crude oil in the case of a crude-oil pipe-line system, and the various products in a products pipe-line system. The presence of water contamination in crude petroleum causes a change in the dielectric constant of the crude which the instrument duly records. The various products of a products system are distinguishable because of their different dielectric constants. The unique feature of the instrument is its ability to respond instantly and precisely to such changes. Because of this feature, it lends itself admirably to the recording, or performing of control functions in certain pipe-line operations.

The author is assistant division manager, Northern Pipe Line Division, Gulf Refining Co.

Field Tests on Crude Systems

In order to check the operation of the water-cut recorder in what might be considered main-line operations, a test unit was installed at a gathering station where the company was accepting delivery of approximately 30,000 bbl. per day of West Texas semisweet crude oil from another carrier. Fig. 1 shows one arrangement of electrodes in a pipe line and Fig. 2 illustrates a typical field test installation. Since the oil had already been accepted by a carrier, it was presumed to be of a reasonably constant quality and within the usual pipe-line requirements. Each delivery was checked in the accepted manner by representatives of both companies.

With only two exceptions, the delivery tickets showed less than 1 per cent b. s. and w.; the general average was well below that figure. In spite of this, thiefing reports revealed an accumulation of b. s. and w. in the delivery tanks. In fact, out of the total delivery of 15,579,461 bbl., some 2,608 bbl. settled in the delivery tanks. The physical arrangements were such that the oil in the tanks was quiet for only 1 hour; the remainder of the time the tanks were in the process of either being filled or emptied. Installation of the recorder revealed the source of the accumulation of b. s. and w., as is shown in Figs. 3 and 4.

Fig. 3 shows a typical type of operation. Grindouts of samples taken at regular intervals agree with the chart record, and for all practical purposes, they establish the possibilities of the device. Fig. 4 shows the same operation, except for a short period between 11:15 a.m. and 11:30 a.m. which shows

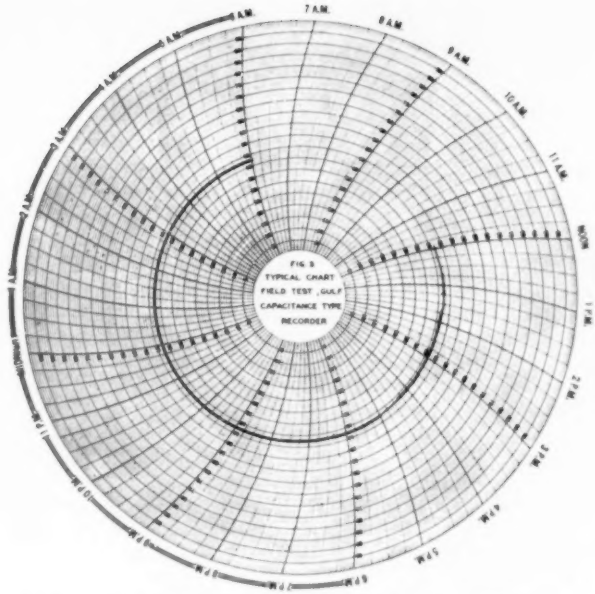

Fig. 3—Typical chart from field test, using Gulf capacitance-type recorder.

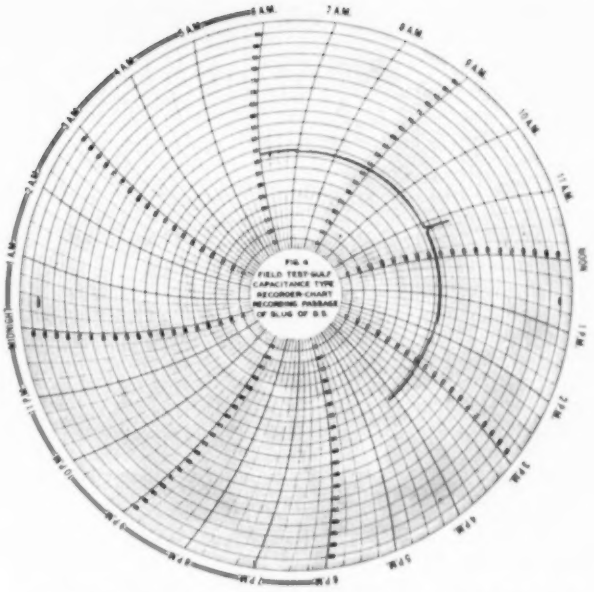

Fig. 4—The recorder clearly shows the passage of a slug of b. s. and w.

a slug of b. s. and w. passing through the pipe line. It was established later that these slugs were regular in occurrence and were connected with scraper schedules in the connecting line. These slugs of oil had a b. s. and w. content ranging from 4 to 20 per cent and arrived in varying volumes, dependent upon pipe-line operating factors.

Timing of the peaks should be noted. Station procedure required samples and grindouts every hour on the hour. Even though the oil received was being faithfully inspected by the usual established methods and procedures, we were receiving undesirable oil. If the timing of the peaks had been such that they would have passed the sampling point at the time of the routine station sampling, considerable misunderstanding could have resulted in the evaluation of the tender. Had our receipts been of such magnitude as those in big-inch pipe-line operations; that is, 10 times the rate of this particular example, the economic loss could reach sizable proportions.

At gathering stations . . . The receipts of oil from a field by a gathering station can vary in gravity as well as in b. s. and w. content, with the various leases producing oil from widely scattered areas, and possibly from different sands. Also, the hourly receipts at the gathering station are usually highly erratic. The operation of the capacitance recorder was checked under these conditions by installing a unit at a suitable location.

Fig. 5 represents a typical day's run. Deviation to the right of normal setting indicates an increase in gravity. A swing to the left indicates a change in b. s. and w. content. The noticeable gravity change, Fig. 5, was due to a block of natural gasoline which was received from a nearby gasoline plant. The erratic flow of oil does not appear to affect the instrument's operation.

Fig. 6 clearly sets out the ability of the instrument to record the presence of excessive b. s. and w. content in a tender of oil. During the day b. s. and w. in varying percentages was received and grindouts agreed with the chart.

The b. s. and w. content of the oil accepted by a pipe-line company is a reflection of the reliability, integrity, and efficiency of the gaging staff. In

TABLE 1—FIELD TEST DATA ON PRODUCTS BATCHER

1	2	3	4		5	6	7	8	9	10	11	12	13
					Actual arrival time of interface								
Test No.	Products batch recorder Chart No.	Recording gravitometer Chart No.	Products change From	Products change To	Dispatcher's interface arrival time*	Gulf products batcher	Recording gravitometer	Hydrometer and color test	Tank switch time	Type of tank switch†	Interface time interval, min.	Orifice flow meter volumes avg. bbl./hr.	Total vol. of interface, bbl.
7	5	4	Gasoline C	Gasoline A	5:35 p.m.	4:58 p.m.	4:59 p.m.	4:59 p.m.	5:35 p.m.	Dispatcher's directive	8	2,338	312
8	6	5	Gasoline A	Gasoline E	2:50 p.m.	2:53 p.m.	2:54 p.m.	2:56 p.m.	2:56 p.m.	Color test	6	2,398	240
9	7	5	Gasoline E	Gasoline B	1:20 a.m.	1:41 a.m.	1:42 a.m.	1:42 a.m.	1:20 a.m.	Dispatcher's directive	6	2,426	243
10	7	6	Gasoline B	Gasoline C	4:45 p.m.	4:50 p.m.	4:51 p.m.	4:52 p.m.	4:55 p.m.	Color test	11	2,393	440
11	8	7	Gasoline C	Gasoline D	9:20 p.m.	9:41 p.m.	9:42 p.m.	9:43 p.m.	9:20 p.m.	Dispatcher's directive	7	2,413	281
12	8	8	Gasoline D	Gasoline A	11:30 a.m.	11:53 a.m.	11:54 a.m.	11:55 a.m.	11:30 a.m.	Dispatcher's directive	8	2,391	320
12a	9	8	Small kerosine batches		8:20 p.m. 10:20 p.m.	8:23 p.m. 10:10 p.m.	8:24 p.m. 10:20 p.m.				6 9	2,400	240 360

*Calculated on displacement figures. †Terminal practice: (1) on dispatcher's directive (on displacement figures); (2) on color test (visual); (3) on hydrometer gravities (between gasoline and kerosine).

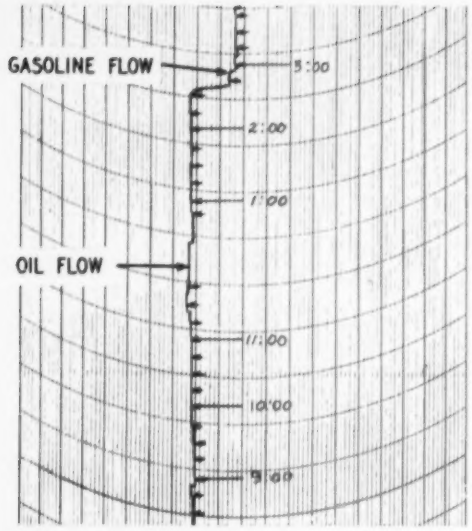

Fig. 5—Chart from recorder showing typical receipts at a field gathering station.

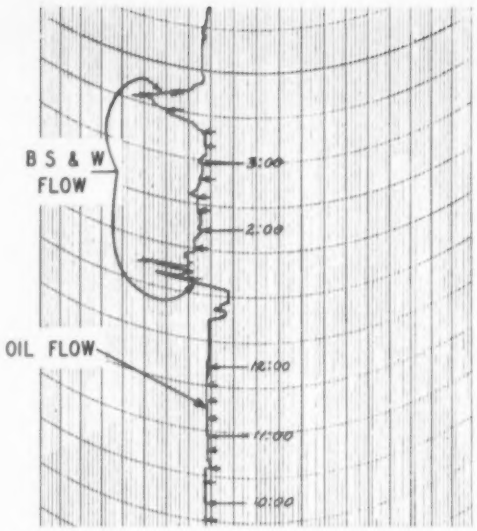

Fig. 6—Receipt of b. s. and w. is plainly indicated on this strip chart from recorder.

the instance of this gathering-station test, the recorder gave a better record of actual happenings than the routine station checking procedure.

Economic considerations . . . The economic aspects of the instrument can, perhaps, be better visualized by considering operations on an annual basis. As a specific example in one pipe-line movement, an annual average of 23,225,414 bbl. was moved from one terminal to another for the years 1949 to 1952, inclusive. During this time, there was accumulated an annual average of 30,562 bbl. of b. s. and w. When it is realized that the b. s. and w. content of the stream out of the receiving terminal was approximately that of the stream received at the initial terminal, it is not unreasonable to assume that the accumulation is the direct result of malfunctioning of the present-day procedure of checking the quality of the oil being transported.

It appears that for the first time in the history of crude-oil pipe lines we now have in the capacitance recorder the means of continuously checking the oil for undesirable qualities and introducing necessary corrective measures.

Other uses . . . Other applications of the instrument can be mentioned. The characteristics of the device enable it to be used as a batch detector, and the intelligence from the instrument may be utilized to energize valve-control mechanisms, thus reducing commingling to a minimum.

With the advent of tank mixing devices designed to keep the b. s. and w. content of crude oil in solution, any pipe line without adequate means of properly checking a stream of oil from a connecting carrier could easily find its storage facilities used as much for a settling basin as for storage. The use of a capacitance-type recorder in connection with a tank mixing device offers distinct possibilities.

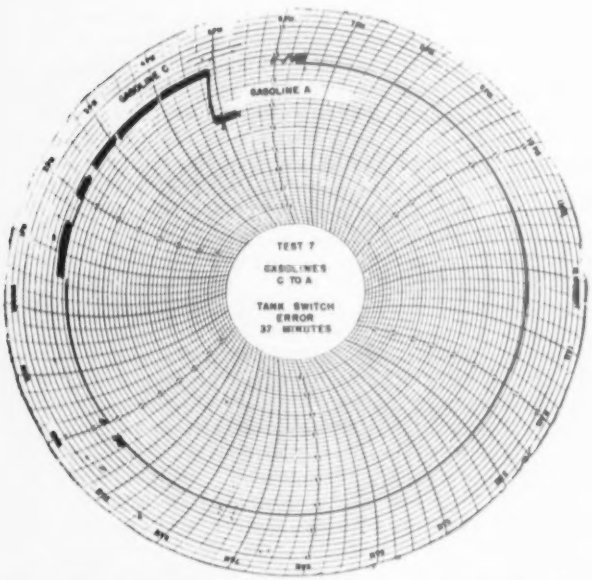

Fig. 7—This chart was made on a gasoline run and shows that an error of 37 minutes was made in the switching of tanks.

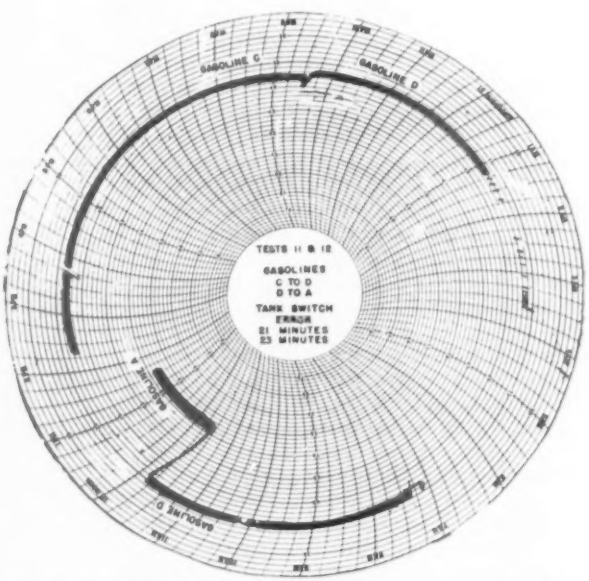

Fig. 8—In this products test the capacitance type recorder distinguished differences among three types of gasolines. The pip on the record between C and D was caused by an injection of kerosine.

By coupling the operation of the capacitance recorder to that of a proportional sampler, physical evidence of b. s. and w. can be obtained. Once the value of the instrument is accepted in the pipe-line industry, the door may be open to many changes. Crude oil is introduced into lease tanks for four reasons, namely: (1) measure gravity, (2) measure temperature, (3) measure volume, (4) measure b. s. and w. content.

Automatic recordings of gravity and temperature offer no serious problems. The use of meters in products pipe lines gives hope that soon the crude lines will follow suit. The capacitance recorder affords a means of checking and controlling the b. s. and w. content of the oil. By a proper combination of these instruments, crude oil might be bought at the lease and delivered to the refinery without entering tankage as we know it today, or reducing its use to a minimum. The steel storage would then be reduced to the function of spill tanks similar to those in a closed pipeline system. This may be especially attractive if meters can be proved easily and quickly under operating conditions.

Applications in Products Systems

Automatic operation of pipe-line systems is being increasingly emphasized. It is, therefore, quite important for the operator to be able to determine not only the product differences and the length of interface, but also to automatically determine the point of cut within the interface and make the proper selection of tankage. Several solutions are used to partially solve this problem. The recording gravitometer can be used successfully for differentiating between products where a sufficient range of specific gravities exist, such as fuel oil, kerosine, and gasolines.

Radioactive tracers and special scrapers have been used successfully to determine interfaces of products. These present certain operating difficulties. The capacitance-type recorder can successfully handle these problems. In addition, it will successfully differentiate between two grades of one product of similar specifications such as the gasoline from two different sources. It is sufficiently sensitive for all changes to make it a versatile instrument for products pipe-line use.

Results of field test . . . In a particular product pipe line used in field testing of an experimental capacitance-type recorder, five different types of gasoline, a kerosine, and a No. 2 fuel oil were being transported, with the interface and point of tank switch between these various products being determined by four procedures: dispatcher's directive, color tests, hydrometer and color, and recording gravitometer.

During the test period, a total of 19 product changes or interfaces between gasoline, kerosine, and fuel oil were successfully recorded. These recordings were checked against the previously mentioned determination methods. The results are tabulated in Table 1. It should be noted that the Gulf instrument was faster than any other type of detection method and at the same time was able to detect all changes, something none of the other methods was able to do.

Typical instrument response for these tests is illustrated in Fig. 7 and shows the clearly defined characteristics of the interface recorded between gasolines whose values in dielectric constant are relatively far apart. Fig. 8 shows the interface between two gasolines whose dielectric constants are nearly equal. In this particular run, the interface was accentuated by the injection of several barrels of kerosine at the point of origin which was about 160 miles from the instrument. This is shown by the slight dip in the chart. These and other tests demonstrate the versatility of the instrument in product pipe-line operations.

Other uses possible . . . Proving systems for checking meter accuracy in products pipe lines are not only expensive, but it is also difficult exactly to duplicate operating conditions. Volumes of calibration tanks are necessarily small and often do not permit testing under the most desirable conditions. The suggestion has been made that the pipe line itself can be used as a proving system by means of a suitable arrangement of automatic dispatching devices, special manifolding, and possibly special scrapers.

Due to the special valve manifolding required, plus personnel to transport scrapers to and from the traps, and the complicated control mechanism, the system may prove cumbersome and expensive. It is thought the same results essentially could be accomplished by use of one or more capacitance-type recorders. By injecting a small amount of foreign liquid a known volume distance upstream from a water-cut recorder, meters could be checked under operating conditions and by volumes not heretofore possible, without the addition of complicated manifolding, additional personnel, etc. Fig. 9 illustrates the simplicity of this arrangement.

Historical Consideration of B. S. and W. Content

The presence of water in crude oil was objected to even before pipe lines existed. An early method of transportation used 42-gal. barrels which were coated on the inside with a stiff glue. The glue was not affected by the petroleum product but was dissolved by the water in the crude, resulting in a leaky barrel which was difficult to handle.

In 1880, United Pipe Line Co., having established the 30,000-bbl. steel storage tank as a standard, referred to depreciation in value caused by evaporation and by water leakage through

(Continued on page 77)

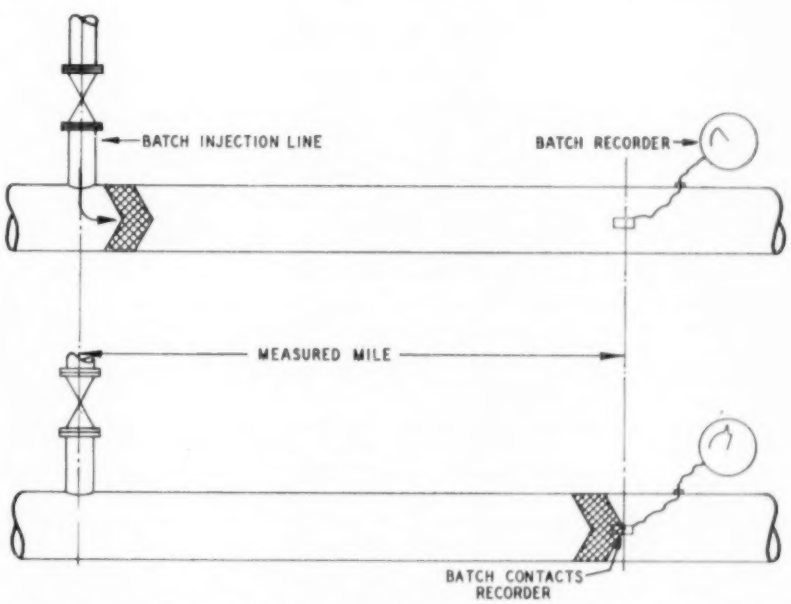

Fig. 9—This schematic indicates the possibilities of using the capacitance-type recorder to calibrate flow meters.

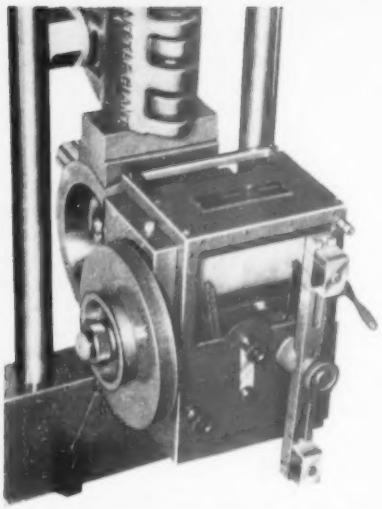

Fig. 1—A ring-type dynamometer. The ring carries the well load and deflects proportionally to the load.

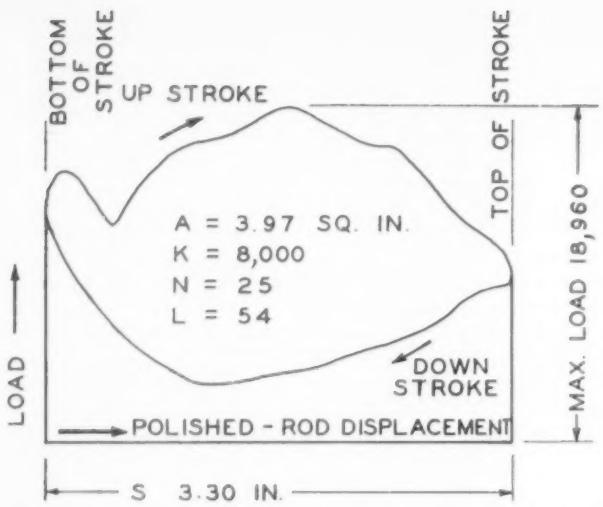

Fig. 2—Typical dynamometer card. Vertical scale records the load, and the horizontal shows the polished-rod displacement.

What Will Dynamometer Cards Tell You

. . . about your pumping well?

The dynamometer as a tool for collection of pumping-well information pays off in reduced well-repair expense and can be used to arrive at minimum pumping-equipment requirements in new wells. The data given by a dynamometer have many general applications which ultimately result in better engineered equipment installations and more economical operations.

This is the first of a series of articles that will explain how the card is interpreted and how to apply the information it gives.

by E. N. Kemler

THE general study of dynamometer cards can be approached either from the case-history standpoint or by analyzing the major factors influencing the shape of the cards and the manner in which they enter the problem. The case-history method is very good except that dynamometer cards differ widely and it is often difficult to find a case just like the one under consideration.

The fundamental approach is in principle good but often too abstract. A combination approach, generally, is the most practical.

The dynamometer can be used to advantage in two general classes of pumping-well problems. The first is the measurement of well loads and polished-rod horsepower for determining well requirements and performance.

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This information is very useful in the selection of equipment and in the overall study of the performance of that equipment. The second use is a detailed analysis of the dynamometer card itself to determine the relative importance of various factors which influence the shape of the card. This information simplifies remedial analysis of wells having high repair expense, and the general solution of pumping problems.

Dynamometer cards can be used to determine polished-rod horsepower, which is the net power supplied at the polished rod necessary for maintaining the specific pumping conditions. This value, when compared with hydraulic horsepower, gives an index of the overall efficiency of the pumping system.

The difference between the polished-rod horsepower and the hydraulic horsepower represents losses due to friction and leakage in the subsurface system. It includes sucker-rod friction, stuffing-box friction, pump leakage and friction, and fluid friction in the production string. Where the pump is handling oil having gas in solution, the work done by expansion of any free gas will be included in this difference and will balance part of the frictional loss.

Questions answered . . . Another application of dynamometer information is in connection with replacement of existing equipment to answer such questions as: (1) What horsepower requirements must the new equipment meet? (2) What are the maximum loads which might be encountered under various operating conditions? (3) What horsepower engine would be required? (4) What probable change in load conditions might be expected with changes in pumping conditions.

Through the collection of general pumping-well data, information on the horsepower and load requirements of pumping from various depths and on various sizes of equipment can be accumulated to serve as a general guide in the study of limitations and requirements of new wells. The information can be used to indicate whether or not smaller pumps might be made to operate satisfactorily or whether shorter strokes might be desirable, as well as other possible changes in operating conditions.

Study of the dynamometer-card shape can also indicate if the well is pounding fluid, if the pump action is normal, the probable effect or change in pump size on load and horsepower requirements, valve action in the pump, time delay in transmission of motion, sucker-rod stretch, effective counterbalance, and similar actions.

Dynamometer Operation

One commonly used dynamometer for well weighing is the ring type, shown in Fig. 1, which has proved to be accurate, rugged, and easily used. The basic element in this instrument is a ring which carries the well load. This ring will deflect proportionally to the well load. This deflection is amplified through levers to cause the recording arm to move; a pulley turns the drum proportionally to the polished-rod motion. This permits the recording arm to draw a diagram of polished-rod load versus polished-rod displacement on the recording drum sufficiently large to be easily used.

The dynamometer is installed on the polished rod on top of the regular clamp above the hanger bar. A second clamp is installed above the dynamometer to carry the well load.

The lower clamp is then released and the polished-rod load is now transmitted from the polished rod to the upper clamp, to the dynamometer and through the lower clamp to the hanger bar. The dynamometer ring now carries the entire well load and will record the load which it carries.

This ring-type dynamometer is relatively simple, easily transported and used, and the general design permits it to be safely applied. When applied in the manner outlined above, there is no change in pump spacing, and the time for installation is short, thereby reducing the possibility of changing of well conditions.

Power and load . . . We are interested in the power supplied to the polished rod and also in the load at various polished-rod positions. The polished-rod position is recorded by connecting the recording drum pulley through a string between the pulley and some stationary object. A motion will then be given to the drum which is proportional to the polished-rod displacement.

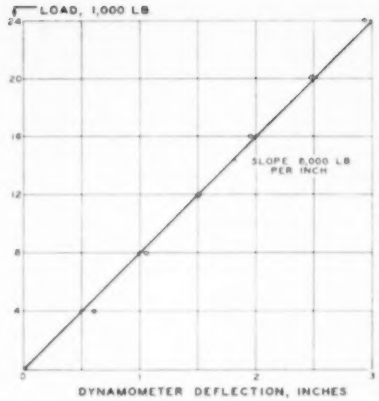


Fig. 3—The plot of a dynamometer's deflection in proportion to load is very nearly straight.

The resultant deflection of the recording arm, which is proportional to the polished-rod load, and the drum rotation which is proportional to the polished rod motion, is a typical dynamometer card as shown in Fig. 2. In Fig. 2 the vertical scale records the load and the horizontal scale the polished-rod displacement.

Dynamometers are designed to give a straight-line relation between the well or dynamometer load and the deflection of the recording element on the dynamometer. The dynamometer is calibrated in a compression testing machine and the true value of load against deflection of the recording element is obtained as in Fig. 3. The slope of the load deflection curve is often called the dynamometer constant (K) and is the pounds load which causes a 1-in. deflection in the recording element. For the example given in Fig. 4, the value of K is 8,000. The load at any position of stroke can be found by measuring the height of the card above the zero line at the desired stroke position and multiplying the value by the corresponding K for the particular dynamometer card.

Polished-Rod Horsepower

The area of the dynamometer card as shown in Fig. 2 actually measures the amount of work during one pumping cycle. The work is the product of force times the distance through which the force acts. Since the force varies constantly, it is necessary to integrate over a cycle. Practically, this can be determined by measuring the area of a dynamometer card.

In this case the vertical coordinant is proportional to the load and the horizontal coordinant is proportional to the displacement of the polished rod. While the mathematical measurement of work would require the evaluation of $\int F\,dx$, this can be obtained very simply either by use of a planimeter or, if such an instrument is not available, by the simple expedient of counting squares on cross-section paper.

The work done during one pumping cycle, as given by the dynamometer card, will be:

$$W = \frac{A\,K\,L}{12S} \qquad (1)$$

where:

W = work in ft.-lb.
A = area of dynamometer card, sq. in.
K = dynamometer constant, lb. per in.
L = length of polished-rod stroke, in.

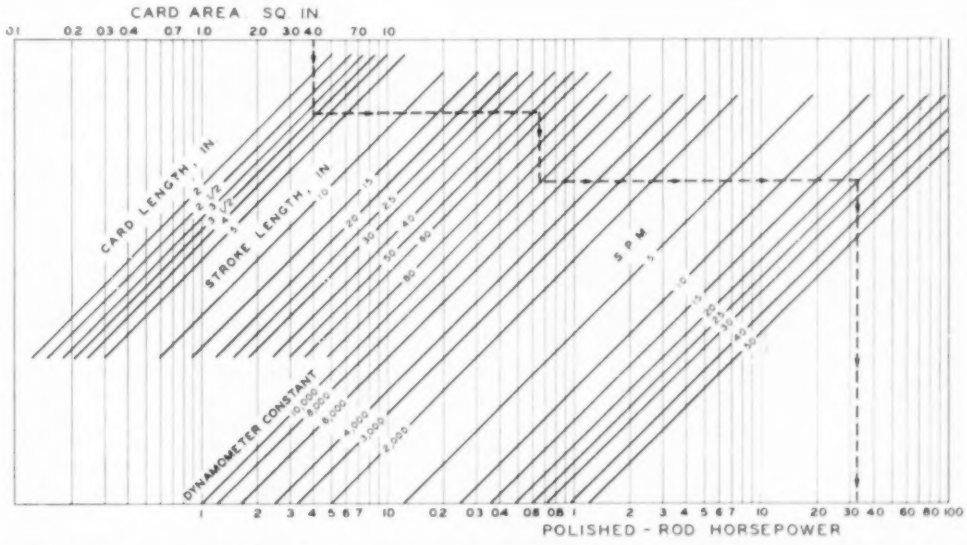


Fig. 4—This nomograph will show the actual polished-rod horsepower from usual dynamometer information.

S = length of dynamometer card, in.

Since the horsepower is the rate of doing work, we have only to multiply Equation 1 by the speed in strokes per minute and divide by 33,000:

$$\text{P. R. HP.} = \frac{A K L N}{12\,(33{,}000)\,S} \qquad (2)$$

where:

N = strokes per minute
P. R. HP. = polished-rod horsepower

Example: The following data were obtained for the dynamometer card shown in Fig. 3:

Card area A = 3.97 sq. in.

Card length S = 3.30 in.

Dynamometer constant K = 8,000 lb. per in.

Pumping speed N = 25 s.p.m.

Stroke length L = 54 in.

Consequently:

$$\text{P. R. HP.} = \frac{3.97\,(8{,}000)\,54\,(25)}{12\,(33{,}000)\,3.30}$$

$$= 32.8$$

Fig. 4 is a nomographic chart which can be used for carrying out the calculation of Equation 2, and it shows the solution of the above example.

Chart is used as follows: Enter the scale marked card area in square inches (3.97 for the above example), trace to scale marked card length in inches (3.30 in. for example), then at right angles to scale marked stroke length in inches (54 in. for example), at right angles to scale marked dynamometer constant (8,000 lb. per in. for example), at right angles again to scale marked strokes per minute (25 for example) and at right angles trace to scale marked polished-rod horsepower (read 33 P. R. HP. for example). This chart can be adapted to long-stroke units by remembering that an increase in stroke length by a factor of 10 will multiply the horsepower by a factor of 10. For a stroke of 200 in., the 20-in. scale is used and the horsepower multiplied by 10.

Subsurface Efficiency

The efficiency of modern pumping and reduction units is very high, probably between 95 and 98 per cent. The engine horsepower will therefore be essentially equal to the polished-rod horsepower, but more exactly, it will be given by

$$\text{Engine output HP.} = \text{P. R. HP.}/C$$

where:

C = the over-all pumping-unit efficiency

The polished-rod horsepower, when used in connection with production information, can also be used for determining the over-all efficiency of the pumping operation. However, this generally has not received much attention because it has generally been felt that there is not much that can be done to improve such operation.

The theoretical hydraulic horsepower required to pump a well is generally considerably less than the actual polished-rod horsepower. This means, therefore, that the efficiency of the subsurface equipment is very low. The following equation can be used for calculating the hydraulic horsepower:

$$\text{Hyd. HP.} = \frac{Q\,h\,\rho}{8{,}400{,}000}$$

$$= \frac{Q\,h\,s}{135{,}000} = \frac{q\,h\,s}{5{,}600} \qquad (3)$$

where:

Q = fluid production, bbl. per day
q = fluid production, bbl. per hour
h = actual lift, ft.
ρ = average density of fluid in lb. per cu. ft.
s = specific gravity (fresh water = 1.00)

It can be seen from this equation that the only two major factors which enter into the theoretical amount of work required to produce a well are quantity of fluid being produced and the height to which it must be lifted. The quantity of fluid can of course be measured. However, the actual lift is a matter which is often not known, particularly in wells which are pumping at less than capacity.

In order to determine the actual lift it is necessary to determine the fluid level, either with fluid-level measuring devices or bottom-hole-pressure gages. In wells which are producing from formations where the closed-in or static bottom-hole pressure is very low, the lift will be essentially that of the pump depth.

Fig. 5 is a chart which can be used in calculating hydraulic horsepower. Enter the chart at the scale marked production in barrels per day, trace to the line giving lift, at right angles trace to line marked specific gravity, and at right angles trace to scale marked hydraulic horsepower. In the example shown, the chart is entered at production of 200 bbl. per day, traced to a lift of 3,300 ft., then at right angles to a specific gravity of 1.0, and at right angles traced to scale marked hydraulic horsepower and read 4.95.

The over-all efficiency of the subsurface equipment will be the ratio of hydraulic horsepower (the theoretical power required) to the polished-rod horsepower (the actual input to the subsurface system); that is, subsurface efficiency

$$= \frac{\text{hydraulic horsepower}}{\text{polished-rod horsepower}} \qquad (4)$$

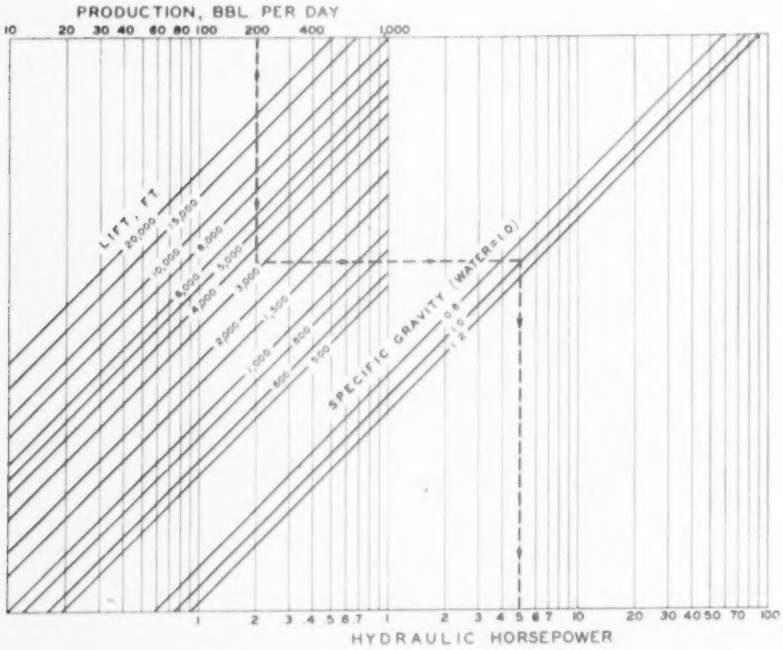
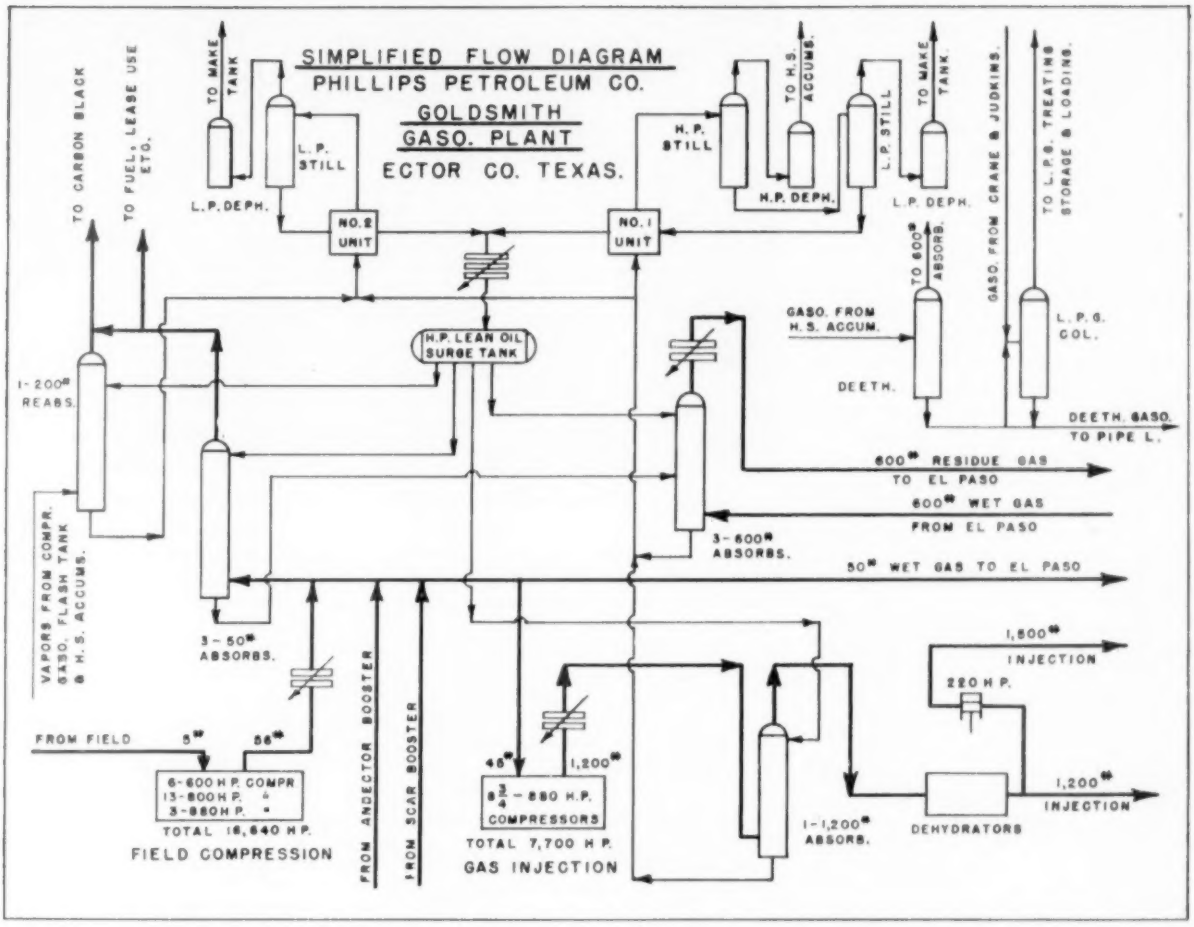


Fig. 5—The theoretical hydraulic power given by this nomograph is generally considerably less than actual polished-rod horsepower.



The Goldsmith natural-gasoline plant handles 250 M.M.s.c.f.d. at three different absorption pressures—50,600, and 1,200 psi.

15 YEARS OF GROWTH

Phillips Now Handling 250 M.M.s.c.f.d. of Gas At Its Goldsmith Gasoline Plant

by LeRoy Culbertson and Bruce S. Weaver

PHILLIPS PETROLEUM CO.'s Goldsmith gasoline plant, located just west of the town of Goldsmith in northwestern Ector County, Texas, provides an impressive example of the practical evolution of an installation designed for the maximum conservation of natural-gas resources.

The plant was first built in 1937-38 to process 50,000,000 s.c.f.d. at 35 psig., with the inlet gas entering the plant under its own pressure and the residue gas burned in a flare, the only outlet available at that time. The plant has since been expanded to handle 250 million s.c.f.d. at three different absorption pressures and even the sour offgases are now utilized in the manufacture of sulfur.

Field Enlargement

The Goldsmith gas-gathering system originally was designed to collect 50,000,000 s.c.f.d. of gas from the Goldsmith San Andres reservoir. This came into the plant under its own pressure through scrubbers in the east and west ends of the plant yard. Drilling extended the oil-producing area, but for 8 years essentially only one reservoir, the Goldsmith San Andres, provided casing-head gas for processing in the plant. Starting in 1946 new formations were discovered and developed so rapidly it was sometimes impossible, with the then-current material shortages, to stay abreast of field enlargements and tie in all of the available gas. This trend is shown in Table 1.

Gathering system . . . Goldsmith field, with its 14 presently producing reservoirs, now extends approximately 19 miles along a north-south axis and varies from 3 to 7 miles in width. The

gathering system has been expanded through the years to cover this area and now includes two large field booster stations. The inlet-gas scrubbers have been increased in number from 2 to 11, and the gathering system with its large 30-in. looped main lines is now designed to handle 250,000,000 s.c.f.d. with a maxium pressure drop of 5 psi. from the traps to the field gas compressor intakes. In May 1953, a total of 2,063 wells were connected to this gathering system, and more connections are scheduled.

Plant compressors . . . Originally all of the inlet gas came into the plant at absorption pressure, but as reservoir bottom-hole pressures began to decline, it became necessary to add field compressors in the plant to take the gas from the traps. In 1941, six 600-hp. compressors were installed, and subsequently thirteen 800-hp. and three 880-hp. units have been added at the plant, as required. A 4-ft.-diameter inlet-gas header has recently been installed along the compressor building to more evenly distribute the large inlet volumes to these compressors.

In addition to compressors at the plant, two field booster stations have recently been completed. Scar booster station, located approximately 4 miles south of Goldsmith plant, has eight 600-hp. compressors, with their auxiliaries and gas-cooling facilities. Five miles north of the main plant is the Andector booster station, with four 880-hp. compressors and their corresponding facilities. This totals 25,060 b.hp. currently on field gas compression service at the main plant and two boosters. All of these have air-fin cooling systems for the engine jacket water and lube-oil cooling-water systems. The discharge gas is water cooled in atmospheric-type cooling towers.

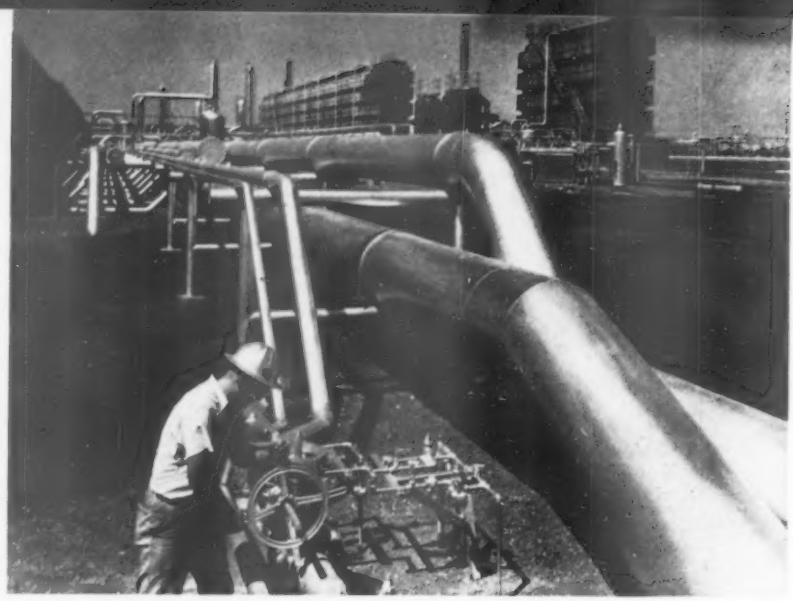
Three Absorption Levels

The original plant processed all gas through two 10-ft. i.d by 14-tray absorbers, where it countercurrently contacted a heavy absorption oil prepared in the plant. In 1941, a third 8-ft. i.d., 60-psi. w.p. absorber was installed. In 1948 as it became necessary to expand absorption capacity, the first of three 7-ft. by 30-tray, 600-psi. w.p. absorbers was installed to process gas being sold to El Paso Natural Gas Co. A third absorption level subsequently was set at 1,150 psi. on gas being returned to various producers for injection into the San Andres formation. Presently nine 880-hp. compressors are assigned to supplying injection gas compression service. The injection gas is dehydrated at 1,150 psig.

The original plant provided for 1,000,000 gal. per day of lean oil over the top of the two absorbers, with 10 times this volume of flashed rich oil flooded back into the midsection of the absorbers. There was no reabsorber, but the vapors from the rich-oil flash tank and three raw-gasoline accumulators were recompressed in four 300-ft. horizontal compressors.

Oil stripping . . . This was done in an 8-ft. i.d. by 10-tray still with a stream near the bottom taken off and heated further in a direct-fired rich-oil furnace, which is still in service between the heat exchangers and the still in what has evolved into the present No. 2 distillation unit. A side stream from the still was used to feed a 4 by 10-ft. absorbtion-oil stripping tower. Both strippers were refluxed with light oil from the bottom of the low-stage gasoline accumulator.

These facilities have been revamped and rebuilt through the years, and enlarged to a total circulation of 3,000,000 gal. per day. The No. 1 distillation unit maintains a lean-oil circulation of 1,800,000 gal. per day, with a 200-psi. w.p. still and dephlegmator in series with a 50-psi. w.p. still and dephlegmator. This two-still system eliminates the need for make tank vapor recom-



Gas-processing equipment at Phillips Petroleum Co. Goldsmith plant.

TABLE 1—LIST OF RESERVOIRS THAT PRESENTLY SUPPLY GAS TO GOLDSMITH

Reservoir—	County	Name	Geologic age	Year of discovery
1. Goldsmith	Ector	San Andres	Permian	1934
2. Goldsmith North	Ector	San Andres	Permian	1936
3. Embar Ellenburger	Andrews	Ellenburger	Ordovician	1942
4. Embar Permian	Andrews	Clearfork	Permian	1942
5. Andector Ellenburger	Ector	Ellenburger	Ordovician	1946
6. Goldsmith Clearfork	Ector	Clearfork	Permian	1946
7. Goldsmith North Devonian	Ector	Devonian	Devonian	1946
8. Goldsmith North Silurian	Ector	Silurian	Silurian	1946
9. Goldsmith 5,600 ft.	Ector	Clearfork	Permian	1947
10. Goldsmith Devonian	Ector	Devonian	Devonian	1947
11. Goldsmith Ellenburger	Ector	Ellenburger	Ordovician	1947
12. Andector McKee	Ector	Simpson	Ordovician	1948
13. Andector Waddell	Ector	Simpson	Ordovician	1948
14. Goldsmith Holt	Ector	Holt	Permian	1951

THE AUTHORS

LeRoy Culbertson is chief engineer, natural-gasoline department, for Phillips Petroleum Co., a position he has held since 1951. A graduate of Kansas State College with a B.S. in mechanical engineering, he joined Phillips upon graduation in 1939. He was engaged in various engineering assignments in field operations until 1943 when he was transferred to Bartlesville. He is a registered professional engineer, and member of Oklahoma Society of Professional Engineers and National Society of Professional Engineers.

L. CULBERTSON

B. S. WEAVER

Bruce S. Weaver is a Goldsmith plant project engineer at Phillips' process, design and development section of the natural gasoline department. After 6 months in the western district laboratory at Odessa, Tex., he was transferred to the Defense Plant Division in Bartlesville, where he helped design the furfural rerun unit, and other parts of the Plains butadiene plant near Borger, Tex. Weaver joined Phillips in 1941 after he was graduated from University of Texas with a B.S. in petroleum engineering in 1940.

pressors on this unit. The No. 2 distillation unit is a conventional one with a lean-oil circulation of 1,200,000 gal. per day and only one low-pressure still and dephlegmator. Each unit has two banks of heat exchangers, two vent tanks, and a direct-fired furnace preheater. In addition to air-fin coolers on numerous services, there are 130 bays of atmospheric cooling tower to dissipate the plant heat load.

Fractionation Section

Originally liquids from the high stage gasoline accumulator were directed to an 800-psi. w.p. 10-tray stabilizer, which was self-refluxing, with the overhead vapors passing into the residue system. There have been many changes in the fractionating area, and now all the raw gasoline, including flashed compression gasoline, is gathered into two 1,000-bbl. vertical blimps which are piped in parallel to act as a combination high stage accumulator and fractionator feed tank.

The raw gasoline is pumped through feed-to-kettle product heat exchangers and on to the feed tray of a 7-ft. i.d. by 30-tray deethanizing fractionator designed to operate at 450 psig. This column, with a capacity of 900,000 gal. per day of feed, recently replaced the two 4-ft. i.d. deethanizers which had been outgrown.

L.P.G. . . . The deethanizer kettle product, after cooling and metering, is piped into the 5,000-bbl. sphere used as a pipe-line surge tank. Downstream of the heat exchangers a sidestream is taken from this deethanized sphere to feed a 30-tray L.P.G. column. The overhead product is cooled and then treated in an L.P.G. caustic treater unit L.P.G. of 90 and 100-lb. vapor pressure is sold to trucks from an adjacent loading rack on the highway paralleling the north fence of the plant yard.

The L.P.G.-column kettle product is cooled and piped to a surge tank where it is commingled with the remainder of the Goldsmith production, the deethanized productions from several Phillips plants located south of Goldsmith, the deethanized gasoline pipelined in from a number of Spraberry Trend plants, as well as various gasoline purchases which enter the system. The commingled stream is delivered via pipe line to Phillips, Tex., for fractionation and further processing at Phillips Petroleum Co.'s Borger fractionator *(The Oil and Gas Journal, April 27, 1953)*. As there is considerable variation in these total volumes, an underground storage well has been drilled nearby in order to iron out the daily and hourly fluctuations and fully load the pipe line at all times. The cavern, dissolved out of a thick salt formation starting at approximately 2,000 ft. underground, has storage capacity of about 110,000 bbl.

A sodium phenolate fuel gas treater, with an absorber and an actifying still, was installed at the time the plant was built. Steam for this unit was supplied by a 75-hp. 150-psi. w.p. boiler. This was subsequently changed to a monoethanolamine unit and steam requirements are now supplied by the main plant steam system. All of the Goldsmith raw-water requirements are purchased from a local water company. Two 10,000-bbl. steel tanks are installed at the plant for water surge and storage. The plant steam requirements are furnished by eight 162-hp. 200-psi. w.p. water-tube boilers. Makeup water passes through a conventional zeolite treater, and additional treatment is supplied internally.

Originally, the residue gas supplied boiler and furnace fuel, and surface lease use for production operations, but most of it was burned in a large plant flare, due to lack of a market outlet. No residue gas is now being flared. The first major purchase contract for Goldsmith plant residue gas was for a carbon-black plant near Douro, built by Defense Plant Corp. during World War II, and subsequently sold to a private concern. After this gas is sold by Phillips, it is passed through a gas treater located adjacent to the Goldsmith plant fence. At later dates, various contracts have been completed with El Paso Natural Gas Co. to supply it with gas to transport through large transmission lines to the West Coast. El Paso receives this gas into large treating and compression facilities located adjacent to Phillips' Goldsmith plant.

Sulfur compression . . . Phillips purchases the hydrogen sulfide streams from both of the two treaters adjacent to Goldsmith plant, as well as utilizing the acid gas from Phillips' small plant fuel treater, for processing in a nearby sulfur-recovery plant constructed and operated by the Phillips Chemical Co. *(The Oil and Gas Journal, January 12, 1953)*.

W. R. Dickens is Goldsmith plant superintendent. Plant foreman is William Greenfield. Chief operator is George Zorns. G. C. McAdams is maintenance superintendent. R. H. Perine is resident technical engineer at Goldsmith, and A. L. Melton is gas superintendent.

Capacitance Recorder in Pipe-Line Applications

(Continued from page 71)

the tank roof "which is converted into an emulsion locally known as b. s." The company had, according to its 1880 annual report, a gross stock of 10,306,078 bbl., of which 454,193 bbl. was estimated to be "sediment and surplus." The provision of United Pipe Line Co. for a 3 per cent surplus of crude petroleum held in custody for delivery is probably the basis for the 97 per cent tank tables that were universally used until 1941.

At the turn of the century, Southern Pacific Railway Co., a large user of crude petroleum for fuel, started buying oil on the basis of centrifuge tests, after discovering that crude that was high in b. s. and w. content made poor fuel. Since the pipe-line companies had to sell on this basis, they forced the same requirements on the producers. The centrifuge was first used to check the b. s. and w. content of crude petroleum in Gulf (or its predecessor) about 1905.

Other advancements, as recorded by instructions to the gagers of the old Gulf Pipe Line Co. of Oklahoma, are as follows:

December 15, 1920

Centrifuge tests required on all runs. B. s. and w. content of anything less than 2 per cent accepted; however, a flat 2 per cent deduction was made.

March 24, 1921

Practice of obtaining samples from connection in side of tank discontinued. Tank was thiefed by strapping bottle to gage pole.

June 16, 1921

Use of hydrometer on each lease once a month was required. Prior to this time, the gravity of the crude petroleum did not affect the price.

April 27, 1931

Oil with only 1 per cent of b. s. and w. acceptable.

January 28, 1941

Use of 100 per cent tank tables inaugurated.

Conclusion . . . Except for minor changes, the manner of checking crude petroleum for b. s. and w. content has remained virtually unchanged since the founding of the pipe-line industry. The application of the capacitance recorder to this and other problems possibly represents one of the newest of the many advancements that have ever been made relative to these problems, and it is one that is compatible with crude oil pipeline operations as we know them today. In the younger products pipe-line industry it has perhaps a more varied and significant application.

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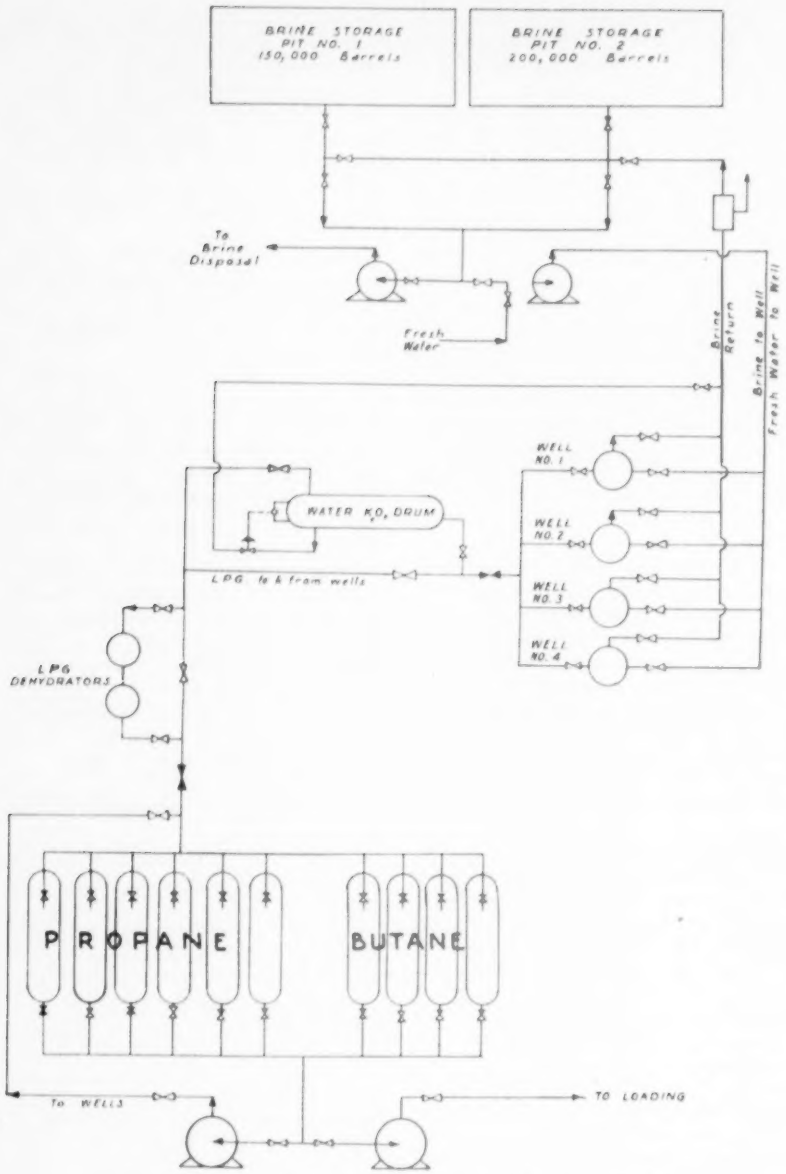


Fig. 1—Schematic flow diagram of underground storage system.

Lion Oil Co.'s experience with

UNDERGROUND STORAGE

... of butane, propane, and gasoline

by W. M. Wilson

AS of November 30, 1951, Lion Oil Co. as operator of a jointly owned gas-processing facility, located in the West Texas area, placed in operation a 50-million-cubic-foot-daily - capacity casing-head gasoline plant. Because of the inherent richness of casing-head gas available for processing, it was apparent at the outset of our plant operations that if total L.P.G. production, the market for which is seasonal, was to be conserved for consumer use, provisions for a large volume of storage would have to be made available.

When initial plant operation was begun, neighboring operators were developing underground storage reservoirs in the Permian salt series. Although at that time few data were available with regard to development and operation of underground storage, a project of this type was initiated in February 1952. Plans were developed which involved an underground storage project consisting of four wells and necessary surface installation comprised of brine-storage pits, pumps, product-dehydrating equipment, as well as L.P.G. injection and water pipe lines.

Storage Project

During the year 1952 three underground storage wells were drilled and storage cavities totaling 75,000 bbl. developed. Of this quantity of storage 34,000 bbl. was utilized for propane during the summer months of 1952. One well was maintained under development for the purpose of increasing storage cavity capacity. Of the above quantity of material stored 91.5 per cent was recovered which resulted in 8.5 per cent loss during the initial storage operation. This degree of loss was not considered excessive in that undoubtedly a great number of pockets or crevices in the storage cavity were filled with L.P.G. which was impossible to recover with the water displacement method employed. During March 1953 a fourth well was completed which has been under development on a continuous basis since that time.

At the present time there is contained in three underground storage wells a total of 101,000 bbl. of L.P.G. which has made possible conservation of total plant production since January 1, 1953. We believe that seasonal improvement of the L.P.G. market will render it unnecessary to store products until after material in storage has been recovered, which is estimated will be not later than April 1, 1954. In addition to conservation of a natural resource and resultant plant economic gain, material that will be recovered from underground storage facilities during the forthcoming season of high consumer demand might well normalize a market that would otherwise be in short supply due to current reduction in crude-oil production allowables and curtailing effect on volumes of casing-head gas available to plants for processing.

Costs . . . Underground storage, as now being developed in various areas where

Author is superintendent of gas department, Lion Oil Co., El Dorado, Ark. Paper presented before Interstate Oil Compact Commission annual meeting at Oklahoma City, December 1953.

salt sections or salt domes exist, affords several advantages to the operator. Most significant is that storage capacity of sufficient volume can be economically developed to conserve total L.P.G. production, which in a majority of cases has not been possible due to seasonal utilization of these materials. At the present time installed cost of steel propane storage tanks is approximately $17.00 per barrel, which applied to the great volume of L.P.G. storage required by the industry would be prohibitive from a financial standpoint based on current product prices. Operating experience to date indicates that underground storage in salt formations can be developed at a cost of less than $1.00 per barrel, which renders the seasonal storage of large volumes of L.P.G. economically feasible.

Economics

Prior to discussing installation and operation of underground storage facilities, economics surrounding the project will be given.

The facilities as herein described involve four storage cavities which are anticipated will be developed to the extent that a total capacity of 900,000 bbl. will result.

Conservation economics . . . It is estimated that the gas-processing plants' share of the value of total L.P.G. conserved during the period from February 1952, date of initial underground storage operations, to April 1, 1954, anticipated date of completion of withdrawal of products now in storage, allowing $0.125 operating expense per barrel of product stored, will be approximately $150,000. On this basis, 34.9 per cent of the estimated total ultimate expenditure of $429,525 for the subject facilities will, before deduction for income tax, be amortized by April 1, 1954. An estimate, taking into consideration future development of storage capacity and conservation of additional L.P.G. products, indicates that the total ultimate expenditure will, before deduction for income tax, be amortized by April 1, 1956. This evaluation of the amortization period has been estimated on the basis that all storage capacity developed to the time of payout will eliminate loss of product and result in a saving of net plant product value with no consideration given to price appreciation due to increased winter as compared to summer L.P.G. market prices. On the basis of 1952-1953 L.P.G. price experience, and operating expense of $0.125 per barrel, it is estimated that a net profit of approximately $0.147 per barrel of L.P.G. stored and recovered could be expected as the result of sales price appreciation.

TOTAL INVESTMENT AND EXTRAORDINARY MAINTENANCE COSTS EXPENDED TO DATE FOR UNDERGROUND STORAGE FACILITIES

Investment to date—	
Land	$ 7,150
Fences and roadways	800
Brine-storage pits (350,000 bbl. total capacity)	43,750
Drilling and completing four underground storage wells	63,875
Drilling and completing one U-tube well	24,600
Pumps, pipe lines, dehydrating equipment, instruments and miscellaneous	72,450
Fresh water and brine-disposal cost	9,300
Electrical power cost	4,300
Operating labor and maintenance labor and materials required for leaching operations	9,800
Total investment to date	$236,025
Extraordinary maintenance expense to date—	
Repair to brine storage pit	$ 16,000
Well workover costs	26,000
Total extraordinary maintenance expense to date	$ 42,000
Total expenditure to date	$278,025
Total underground storage developed to date, bbl.	156,000
Cost per barrel of underground storage developed to date	$ 1.78
Estimated future investment for underground storage facilities—	
Drilling and completing two U-tube wells	$ 30,000
Fresh water and brine-disposal cost	44,000
Electrical power cost	20,500
Operating labor and maintenance labor, and materials required for leaching operations	47,000
Miscellaneous	10,000
Total future investment	$151,500
Plus total expenditure to date	278,025
Estimated total expenditure	$429,525
Estimated total ultimate storage capacity, bbls.	900,000
Estimated cost per barrel of ultimate storage	$ 0.4773

Underground-Storage Facilities

Facilities have been installed as illustrated on the accompanying schematic flow diagram (Fig. 1). The four underground storage wells are located on 40-acre spacings, which acreage is considered more than ample to prevent communication between the storage cavities leached out of the salt section when completed at their ultimate capacity of approximately 225,000 bbl. each.

Two brine-storage pits of 150,000 and 200,000 bbl. capacity, respectively, have been installed for the purpose of storing a portion of brine produced as the result of leaching operations. This quantity of brine storage is for the purpose of providing surge capacity necessary for disposal of brine which, in this case, is to the production department of Lion Oil Co. for use in pressure-maintenance operations. Utilization of brine for pressure-maintenance operations affords an economic means of disposal which would otherwise require providing brine-disposal wells at increased project investment cost. The brine storage is also to provide an adequate volume of water to permit rapid displacement of stored products necessary during periods of high market demand for which purpose the current supply of fresh water is not sufficient.

Product dehydrating equipment consisting of a water knockout drum and a solid-desiccant-type dehydrator has been installed for the purpose of removing entrained water, and also extraction of water of hydration from L.P.G. being displaced from storage.

Pumping equipment . . . Necessary pumping equipment consists of three units. A 300-g.p.m.-capacity motor-driven centrifugal pump has been provided for the purpose of transferring fresh water into wells for leaching, as well as injecting either fresh water or brine to displace stored products. A pumping unit of equal capacity is installed for the purpose of disposing of brine produced. The last unit required is an L.P.G. injection pump for L.P.G. materials to be transferred from steel storage tanks to underground storage.

Lines . . . A portion of the pipe lines required consist of fresh-water injection lines installed between the fresh-water injection pump and four wells involved, as well as brine return lines from wells to the brine storage pits. For the purpose of injecting and withdrawing L.P.G., a line has been provided between the storage tanks and wells in such a manner as to accom-

modate either operation. This type of installation was possible due to the seasonal factor relative to underground storage operations in that L.P.G. is injected during the summer months, period of low market demand, and withdrawn during the period of high demand, which occurs during late winter and early spring.

Brine for pressure maintenance . . . Subsequent to initial operation of the underground-storage project, it was found desirable to recirculate brine produced from a newly completed well to obtain maximum saturation to achieve total usage of fresh water. It was also determined that it was necessary to supply the production department of Lion Oil Co. oxygen-free brine for pressure-maintenance operations. Both of these factors required that brine be introduced to the respective pumps prior to discharge into the brine-storage pits. On this basis, operating experience dictated that in addition to the above-mentioned major items of equipment, it would be necessary to install a vessel to facilitate the removal of entrained L.P.G. from brine produced as the result of leaching operations. This installation was necessary for the reason that wells after being emptied of stored materials were leached to create additional capacity and L.P.G. trapped in pockets formed in the salt cavities was liberated in brine produced, which caused intermittent vapor locking of pumping equipment.

Operating the Facilities

Fresh water supplied from deep water wells is transferred by means of the fresh-water injection pump to one of the four wells not in service as a storage unit where it enters the tubing string and flows to a point in the well bore, or storage cavity, near the base of the salt section. Fresh water discharged into the salt section in this manner by virtue of turbulence created by the water velocity and residence time in the cavity dissolves sufficient salt to produce brine of 80 to 85 per cent saturation. Brine so produced is discharged from the storage cavity through the annulus between the casing and tubing. Brine effluent from the well head is transferred by pipe line to the vapor separator from which point a portion is taken for delivery to pressure-maintenance operations with the remaining quantity flowing to the brine-storage pits.

As mentioned previously, provisions were made to recirculate brine solution to effect maximum saturation to conserve fresh water. It has been determined that the degree of saturation is effected not so much by velocity of the fresh water flow in contact with the salt formation being leached but residence time of the water in the cavity in contact with the salt. Due to this factor, it has been necessary to recirculate brine only during initial leaching of a newly completed well until the size of the storage cavity is developed to approximately 2,000 bbl., at which point solution attributable to residence time is effected.

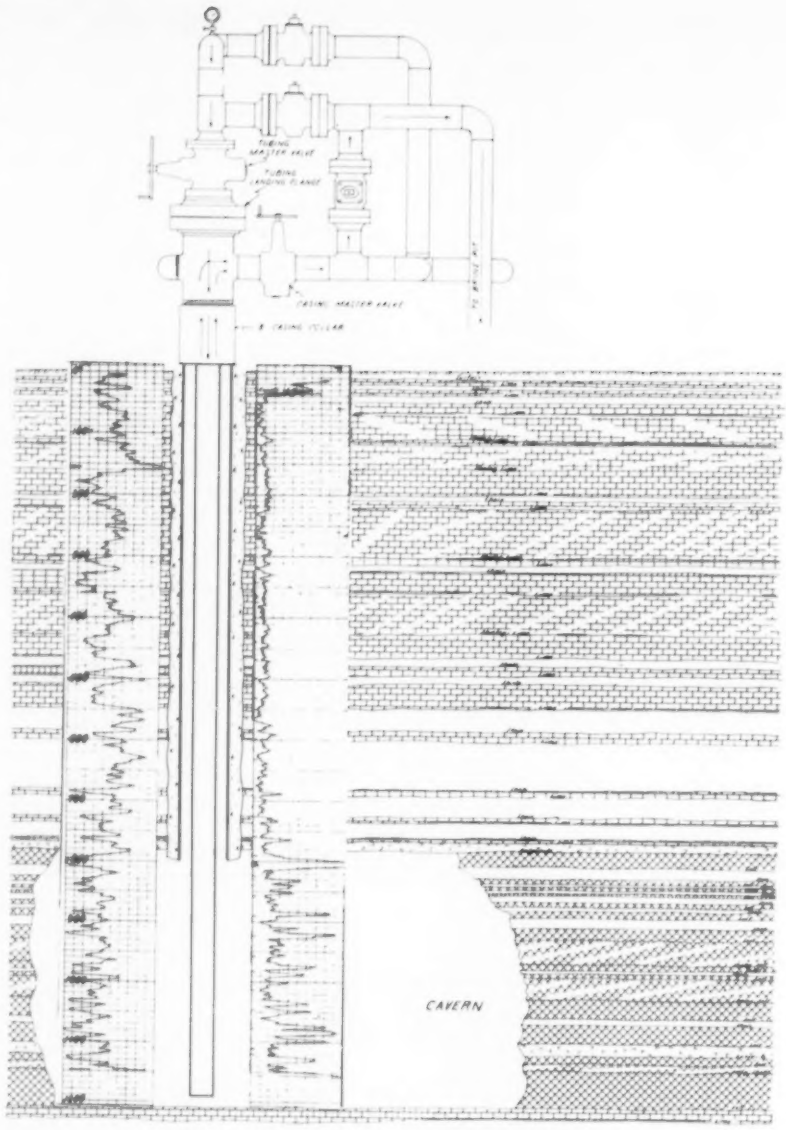


Fig. 2—Typical underground storage-well installation.

Injection of L.P.G. . . . This is accomplished in the following manner. Washing operations on the well selected for storage of L.P.G. are discontinued and manifolding of the L.P.G. pipe-line arranged so that L.P.G. pumped from storage can be transferred directly to the well without passing through the solid-desiccant-type dehydrator and water-knockout drum. L.P.G. is then injected into the well in the annulus between the tubing string and casing, which results in brine being displaced from the cavity through the tubing string to the brine storage pits. Upon completion of the injection operation, the well is shut in until such time as it is necessary to withdraw stored materials for sale.

Withdrawal of stored materials is accomplished by injecting brine or fresh water into the well into the tubing string and displacing L.P.G. through the annulus between the tubing and casing. L.P.G. so displaced is returned to plant product storage tanks through the previously mentioned injection line, manifolding of which has been adjusted to facilitate passing the product being withdrawn through the water knockout drum and solid desiccant-type dehydra-

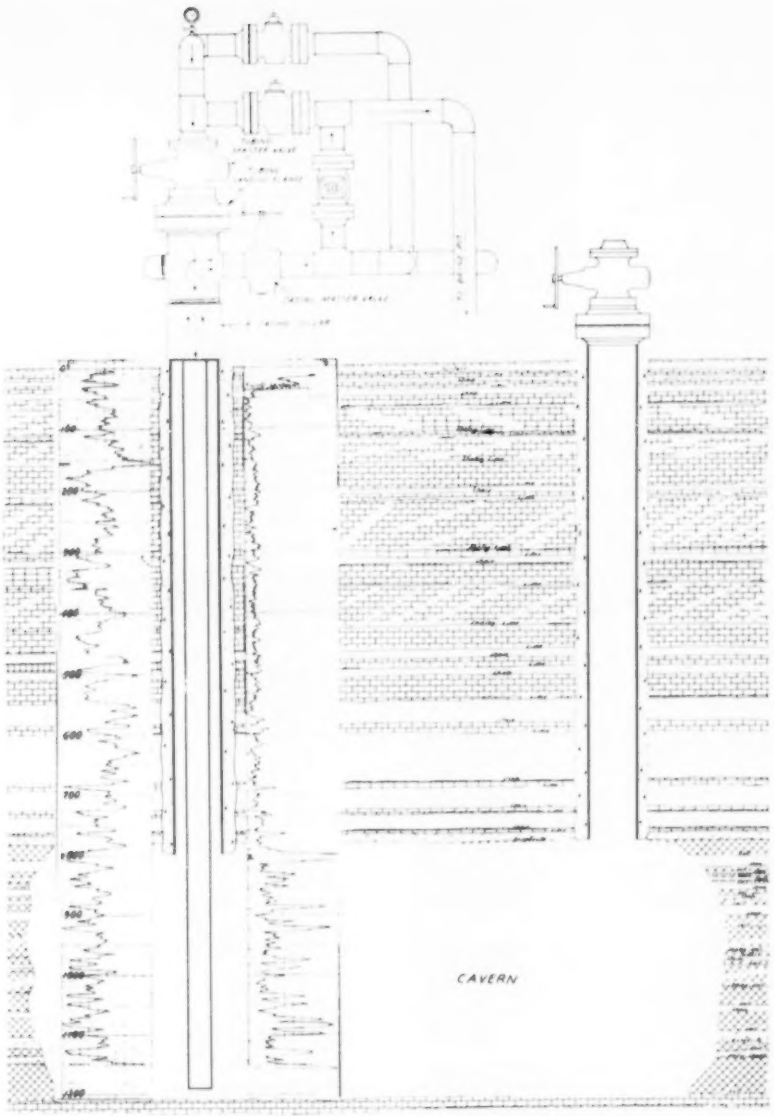


Fig. 3—Typical underground storage-well U-tube-type installation.

tor for the purpose of extracting water entrainment and water of hydration.

Operating Experience

Operating experience with regard to drilling and completing, as well as leaching storage cavities in the four wells completed to date, is as follows. Wells No. 1, 2, and 3 were completed in accordance with the method as indicated in Fig. 2. It should be pointed out at this time that the salt formation existing in this particular area of West Texas is not ideally suited for installation of salt-cavity storage due to the fact that the salt section is heavily interbedded with stringers of shale and anhydrite. This inherent structure of the salt section was responsible for considerable well-operating difficulties during leaching operations prior to initial use of each of the three wells for storage of L.P.G. products.

Difficulties experienced were directly attributable to caving occurring in the cavity being formed in the salt section. This was the result of solution of salt contained between stringer formations, which caused them to disintegrate and fall into the storage cavity. This condition with respect to all wells resulted in the portion of the tubing strings extending from the top of the salt section to the base being broken off, or deformed to the extent that L.P.G. storage operations could not be conducted without the possibility of incurring exorbitant product loss, which necessitated a considerable amount of remedial work in the form of well workovers. Remedial work necessary to perform consisted of pulling tubing and fishing operations to recover the portion of tubing that had been broken off and remained in the salt cavity; redrilling the salt section and installing liners fabricated of proper size casing perforated near the base of the salt section to serve to protect the tubing string from future caving.

Dual-well installation . . . The above type of workover operation was conducted on Wells Nos. 2 and 3. On well No. 1, however, the well initially completed in the underground-storage program, an attempt to pull the tubing for inspection, prior to utilizing for storage, was unsuccessful due to the fact that caving of shale stringers in the storage cavity had bent the tubing and filled the cavity with cavings to the extent that the tubing was not removable. The idea was then developed which involved what is now termed U-tubing. This operation consisted of offsetting the initially completed well approximately 40 ft. and drilling and completing a second well in the salt section and leaching the U-tube well until communication with the original cavity was obtained. This method of completion is as illustrated in Fig. 3.

This type of dual-well installation for the purpose of creating and operating a common salt-storage cavity has the advantageous feature of permitting leaching of the storage cavity and withdrawal of stored products without the use of tubing string in either well. A tubing string is required in this type of installation only at times when L.P.G. is being injected for storage, which permits the displacement of water from the cavity at a point near the base of the salt section, and in this manner prevents loss of products due to entrainment in brine effluent from the well head, which would otherwise occur. Due to this feature, it is possible to maintain the storage cavity free of tubing during periods of leaching storage capacity, eliminating the damaging results of caving action and subsequent expensive well workover cost previously experienced.

The No. 1 well which has been U-tubed, as described above, has operated on a trouble-free basis since being completed, during which time leaching in the common cavity has been done, as well as products stored and withdrawn. Also, in connection with the experimental operation of this well, leaching has been conducted during a period when the well was partially filled with L.P.G. The method of leaching in this case was by introducing fresh water into one of the U-tube wells not equipped with tubing and displacing water from near the base of the salt section through tubing installed in the

(Continued on page 86)

ACCORDING TO THE AUTHOR . . .

● **Where there are zones of reduced permeability around the well, fractures bypassing this zone increase the producing rate, and in many instances the ultimate recovery. This allows exploitation of zones when productivity is impaired by drilling methods or where well fluids tend to plug the formation near the well. This type of application is probably most typical of fracture treatments being performed at present.**

● **If at least one deep horizontal fracture is extended laterally into a vertically continuous oil reservoir, commercially attractive production may be achieved even though permeability may be considerably below that otherwise required.**

● **The exact permeability range within which deep fractures take on practical significance is difficult to define. It appears reasonable that one might tentatively define this range as falling between 0.1 to 5 md. as normally reported on cores. More experience may justify extending this range either direction.**

● **Well spacing required for the development of extremely tight formations would seem to be controlled by ability to extend fractures.**

● **In more permeable reservoirs where water may be used as a driving agent, deep penetrating fractures would result in severe channeling. It does not seem at present, however, that minimum permeabilities required for successful water flooding are low enough to fall within the range suggested herein for utilizing deep fractures. Where productivity or injectivity in water flooding projects can be improved by fracturing, fracture penetration of 10 to possibly 50 ft. would detract relatively little from the over-all sweep efficiency.**

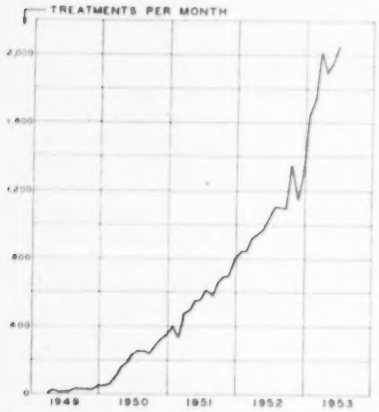


Fig. 1—Growth of the hydraulic fracturing process.

Hydraulic Fracturing . . .

From 18 to 1,900 treatments per month in 4½ years is record of new production tool

by George Roberts, Jr.

THE need for methods of stimulating production from oil and gas wells has long been a major problem in the petroleum industry. Attempts to solve the problem led to the development of such techniques as underreaming, shooting, and acidizing. However, each of these, for one reason or another, had limited application. To fulfill the need for a stimulant that would be more widely applicable to wells producing from all types of formations, a process to increase well productivity by hydraulically fracturing the producing formation was developed.

The growth and general acceptance of this method is illustrated by comparing the number of wells being treated each month during the 4½ years the process has been in commercial use. Fig. 1 presents graphically the approximate number of wells treated per month. In 1949, only 18 wells per month were treated. During the first 6 months of 1953, the average treating rate was approximately 1,900 wells per month.

During the time the technique of hydraulic fracturing has been available, the equipment used to treat the wells has undergone much growth and development. In the initial stages, a typical fracturing job employed a small centrifugal mixing pump, three welded steel tanks, and one displacement pump. The materials used consisted of approximately 20 bbl. of treating fluid containing 400 lb. of sand.

In comparison, a present-day commercial hydraulic fracturing treatment may utilize as many as six 15,000-psi. w.p. pumps which are used to displace as much as 2,400 bbl. of treating fluid containing 50 tons of sand as the propping agent.

Basic mechanism . . . The basic hydraulic fracturing process consists of injecting a low penetrating fluid into the producing formation at a sufficiently rapid rate to create and extend a fracture. A low penetrating fluid is one of relatively high viscosity or of low fluid loss character as compared to the formation fluid.

If the producing formation is acid-soluble, i.e., limestone or dolomite, the fracturing fluid is usually a thickened acid. If the formation is not acid-soluble, such as sandstone, the fracturing fluid may be natural or thickened crude oil or kerosine, viscous fuel oil, or other materials having the right properties.

Graded sand is carried by the fracturing fluid into the fracture and serves to keep it from closing when the pressure is released. The concentration of sand in the fracturing fluid may vary from ½ to 5 lb. or more of sand per gallon of fluid.

It is desirable that the fracturing fluid revert to a thin liquid for ease of removal, and to insure that very little propping agent is backwashed from the fracture when the well is placed on production. This is accomplished by dilution with the formation fluids, result of bottom-hole temperature, or by the use of incorporated gel breakers, thinners, and the like.

From this brief description, it may be seen that hydraulic fracturing increases the productivity of oil or gas-bearing formations by creating cracks or fractures of relatively high fluid-carrying capacity in the reservoir rock. A picture of a fracture formed by this method is illustrated in Fig. 2.

Reasons for success . . . In considering the effect of hydraulic fracturing on exploration, it is helpful to review the actual conditions caused by fracturing

Author is manager research department, Stanolind Oil & Gas Co., Tulsa. Paper presented at the regional A.A.P.G. meeting, Wichita, October 2, 1953.

Fig. 2—Fracture created by hydraulic fracturing in a shallow well.

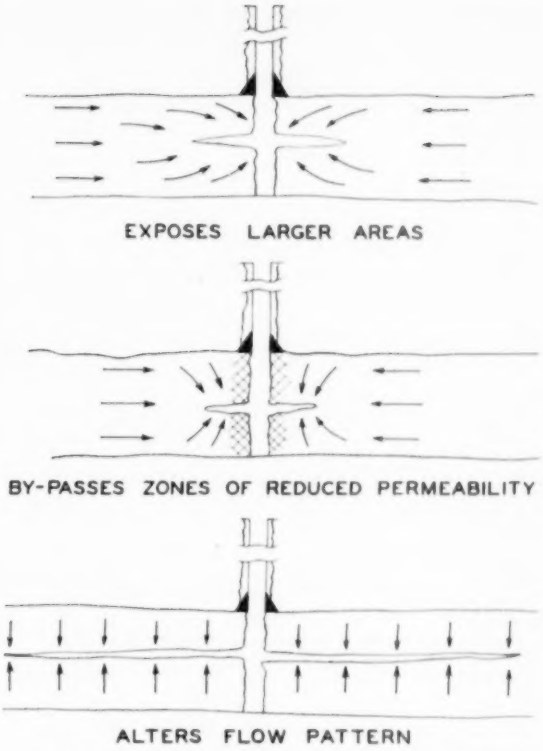


Fig. 3—Reasons for increased use of hydraulic fracturing.

which result in increased productivity. There are three mechanisms contributing to the success of hydraulic fracturing and these are represented in Fig. 3.

Increasing effective well-bore radius . . . In uniformly high-permeability formations, the increase in productivity is due to exposing larger areas through which the produced oil may flow relatively unrestricted. In effect this amounts to increasing the diameter of the well. In general, the percentage production increases due to this area enlargement are relatively small.

Bypassing zones of reduced permeability . . . Quite often formations are adversely affected by drilling and completing techniques. Here there often is created a relatively thin zone around the well bore in which the formation permeability is greatly reduced, perhaps by the swelling of clays native to the producing formation, intrusion of the mud solids, or possibly water-blocking in oil-wet formations. Also, the accumulation of very fine particles of solid or semisolid material entrained in the reservoir oil, and moved toward the well, may gradually plug areas immediately adjacent the well. Under such conditions, the productive capacity can be greatly increased by fracturing through this zone to provide a low-resistance path into the well for the fluid from the formations.

The magnitude of the increase in producing rate due to bypassing local reduced permeability, of course, depends on the extent of well damage. It is not uncommon, however, to increase the producing rate tenfold or more by fracturing through such a zone. To date, most of the spectacular results from fracturing are due to this mechanism.

Alters flow pattern . . . A third condition where hydraulic fracturing has resulted in large increases in productivity is in uniform but very tight formations, where permeabilities might range from possibly .1 md. up to maybe 5 or 10 md. and having a flow capacity index in the order of 5 to 50 md.-ft. One reason for low rates of production is that all the produced oil must funnel through the low-permeability rock forming the well walls. Thus the bottleneck caused by the radial nature of fluid flow to wells is responsible for the difficulty in producing at commercial rates from low-permeability formations.

The capacity index of a fracture may vary from 30 to more than 1,000 md.-ft. with possibly 300 md.-ft. as a good average. Radial flow at commercial rates through this capacity index is possible without excessive pressure drop. Thus by creating a deeply penetrating fracture, the limitation imposed by the radial nature of flow into wells in tight formations can be largely overcome. Flow through the low-permeability rock follows a short linear path to the fracture, thence radially to the well through this highly permeable path.

After enough oil and gas have been produced to lower the pressure in the rocks flanking the fracture, flow will again be radial in the tight rock from the formations beyond the end of the fracture; however, the effective well-bore radius is much larger and offers less resistance.

Application of proper fracturing processes to these tight oil-bearing formations may bring many heretofore uneconomic reservoirs into commercial production. This may be of significance to exploration plans.

With deep fractures . . . Where there is adequate oil in place and sufficient gas in solution as a source of energy, commercial recovery should be obtained from low-permeability formations by creating deeply penetrating fractures. Calculations were made for several hpothetical reservoirs to investigate recoveries from low permeability formations.

Fig. 4, a plot of per cent recovery of the oil-in-place versus formation permeability, presents the results of these analytical studies which show that substantial recovery may be obtained from extremely low permeability formations.

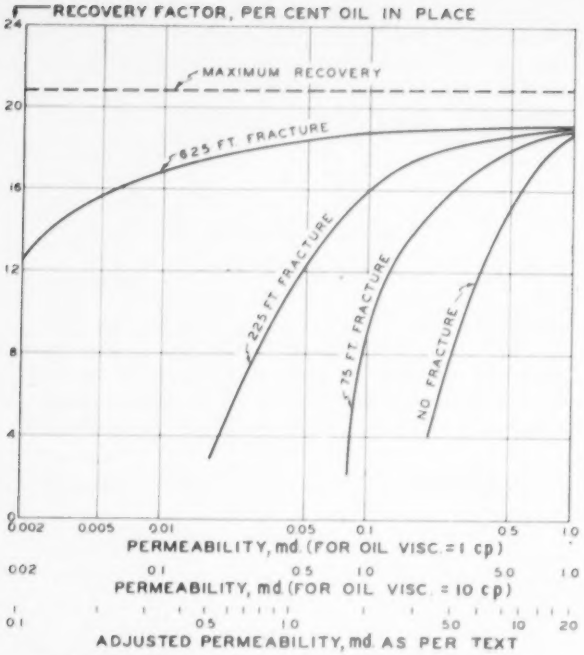

RECOVERY FACTOR, PER CENT OIL IN PLACE
MAXIMUM RECOVERY
625 FT FRACTURE
225 FT FRACTURE
75 FT FRACTURE
NO FRACTURE
PERMEABILITY, md (FOR OIL VISC. = 1 cp)
PERMEABILITY, md (FOR OIL VISC. = 10 cp)
ADJUSTED PERMEABILITY, md AS PER TEXT

Fig. 4—Effect of formation permeability on ultimate recovery.

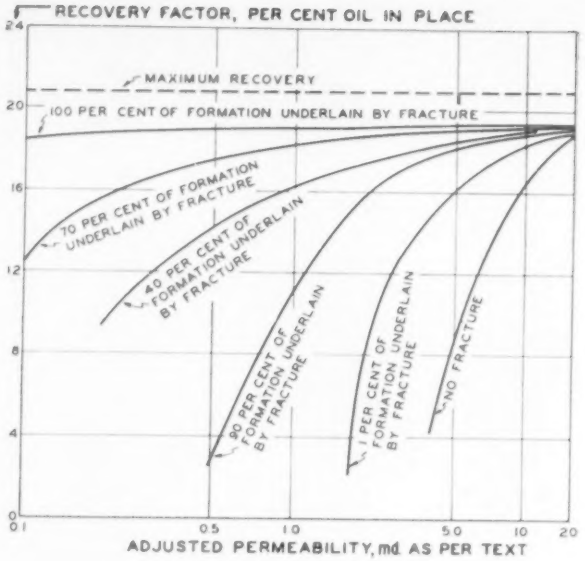

RECOVERY FACTOR, PER CENT OIL IN PLACE
MAXIMUM RECOVERY
100 PER CENT OF FORMATION UNDERLAIN BY FRACTURE
70 PER CENT OF FORMATION UNDERLAIN BY FRACTURE
40 PER CENT OF FORMATION UNDERLAIN BY FRACTURE
90 PER CENT OF FORMATION UNDERLAIN BY FRACTURE
1 PER CENT OF FORMATION UNDERLAIN BY FRACTURE
NO FRACTURE
ADJUSTED PERMEABILITY, md AS PER TEXT

Fig. 5—Reasonable yardstick for well spacing from 5 to 40 acres per well.

providing a deep fracture is created. The maximum recovery shown on Fig. 4 is based on a solution-gas drive which is the only recovery mechanism likely in such tight formations.

In preparing this plot, it was assumed that either of two types of crude (abandonment viscosity 1 and 10 cp.) were contained in a 30-ft. formation of typical relative permeability characteristics.

A 30-md.-ft. fracture was considered to extend radially from the well bore to radii of 0, 75, 225, or 625 ft. in a well drilled on 40-acre spacing and produced to an economic limit of 10 bbl. of oil per day. For example, with a permeability of .1 md. and 1-cp. oil, there would be no recovery without fracturing; a 75-ft. fracture, about 9 per cent recovery; a 225-ft. fracture, about 16 per cent recovery, and a 625-ft. fracture, some 19 per cent recovery. This is for a 40-acre spaced well.

Similar calculations for formations varying in thickness from 30 to 300 ft. and fracture flow capacities 10 times greater indicate recoveries in the same order of magnitude.

Why deep fractures . . . The effect of fracture depth on recovery for any one permeability in low ranges is quite significant and indicates the value of achieving maximum fracture penetration in tight formations. Recovery factors for the oils shown on Fig. 4 can be achieved only if the crude oils in the formation are true liquids. This may not always be the case. In very tight reservoirs, the presence of suspended particles in the oil, which might be brought about by pressure reduction, would be expected to further reduce the permeability throughout the producing life. Very likely the tighter the rock, the more serious would be the reduction percentagewise. Because of these factors, permeability measured in the laboratory may be considerably greater than effective permeability in the reservoir.

Experience suggests that permeabilities of even greater magnitude than shown on either viscosity scale on Fig. 4 might still be low enough so that recovery is significantly increased by deep fractures. This might be explained as mentioned before by the presence of suspended particles in the oil or by a serious change of relative permeability characteristics in very tight rocks from what might normally be expected.

In any event, the upper limit of permeability indicated in the two viscosity ranges should not be considered as the permeability above which deep fracturing cannot be considered beneficial.

At this time probably no one can define precisely the exact permeability limitations, as measured in cores, that should lead to performance as indicated on Fig. 4. Permeability requirements for deep fractures in different fields may shift up or down from the values on the chart, depending upon character of oil, uniformity of pay, relative-permeability characteristics, and economic factors.

Experience will tell . . . Actual experience in completing wells in tight formations should offer indications of the permeability levels below which commercial production cannot be achieved without fracturing or the equivalent. Permeabilities progressively lower than such an established level will require greater fracture radii to permit normal recovery.

Although a detailed survey of this experience has not been made, it is believed that one would find it difficult to develop without fracturing, or the equivalent, satisfactory producing rates and normal recovery efficiency with permeabilities less than 1 to 5 md. for the average oil. Exceptions would very likely be found where a relatively high-permeability streak is present in the pay; this would be somewhat comparable to the presence of a deep fracture.

Therefore, with judgment more than specific data as a basis, the adjusted scale on Fig. 4 has been added. It is admittedly arbitrary, but seems to more accurately provide a transition range of permeabilities from that yielding normal recovery without fracturing to that where normal recovery is only possible with very deep fracturing.

In substance, the selection of this arbitrary scale indicates simply that one could not confidently depend upon completion methods short of fracturing as permeabilities get less than approximately 5 md. and that progressively deeper fractures will be required as permeability descends to approximately .1 md. and below. For permeabilities below approximately .1 md., even the deepest fracture may not be adequate unless it is found that even at those extremely low permeabilities, oils still behave as true liquids.

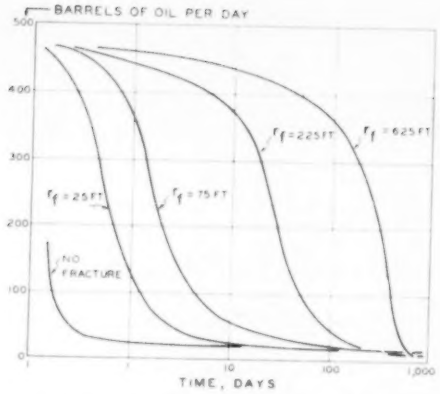


Fig. 6—Effect of fracture radius on production.

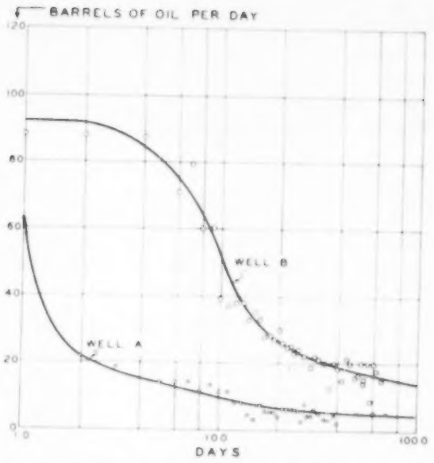


Fig. 8—Effect of large fracture treatment on production from a tight formation.

Experience gained from recovery in extremely tight formations, as a result of deep fracturing, may require revision of these permeability limits both upward and downward.

However, one does not have to be absolutely sure of these permeability ranges in order to take advantage of this type of development. If satisfactory production cannot be achieved in reservoirs which contain substantial oil by short fractures, acidizing, etc., then a deep fracture could very likely be employed to obtain commercial production.

To overcome plugging . . . The widespread successful results obtained from fractured wells led to the realization that permeability reduction near the well by something entrained in the reservoir fluid is common. In such a situation, a large increase in productivity will result from making fractures just long enough to penetrate the zone of reduced permeability.

However, if the plug is due to the accumulation of materials entrained in the reservoir fluids, more plugging can be expected because all the oil produced from the well must converge and flow through the bottleneck formed by the rock forming the well walls; or in the case of a fractured well, the rocks flanking the fracture plus the well walls. If a deep penetrating fracture is made, a tremendous area must be plugged off before flow is seriously affected.

In fact, for a 300-ft. fracture in a 30-ft. formation, over 12,000 times as much rock is exposed through which the fluids can drain than in the case of a 6-in.-diameter well bore. Thus in the case where solids are entrained in the reservoir fluids, we can expect production increases to be sustained for a much longer time when a deep penetrating fracture is made.

The pore-space diameter between the propping agent sand grains normally recommended in fracturing processes would be some 25 to 75 times greater than that in the type of tight formation visualized in this analysis. Particles entrained in the oil and not screened out when passing through the tight rock would not likely bridge and plug the fracture; however, if fracture plugging were to become serious, it could likely be reopened by refracturing.

While the relationships shown on Fig. 4 are based on 40-acre spacing, it should be recognized that depth or radius of fracture is important in that it determines the ratio of the fracture area to the well's drainage area.

Fig. 5 shows the same relationships keyed to per cent of the formation underlain by a fracture rather than fracture radius. This will reasonably apply to any spacing between 5 and 40 acres per well. For example, if one wanted to fracture 70 per cent of the area under a 10-acre well, he would create a fracture with a radius of approximately 310 ft.

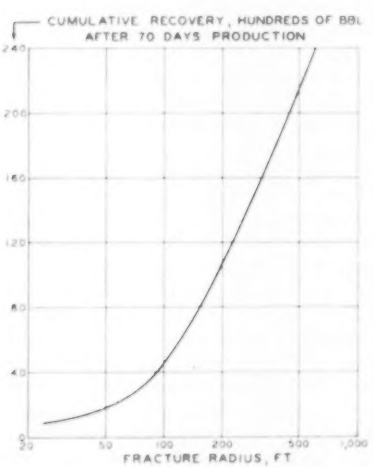


Fig. 7—Effect of fracture radius on rate of recovery.

Increased production . . . Additional analytical calculations were made to determine the rate of production resulting from the creation of a deep fracture. The reuslts of these calculations are presented in Fig. 6 which is a plot of producing rate versus time plotted on a logarithmic scale. In this plot the formation permeability was assumed equal to 0.2 md., the formation thickness 30 ft., oil in place 12,000 bbl. per acre, initial pressure 1,750 psi., fracture flow capacity 30 md.-ft., and 40-acre spacing. It was assumed that a 100-psi. back pressure was held against the sand face.

This plot shows that high rates of production could be maintained for a much longer time when deeper fractures were made. In making these calculations, it was observed that the high rates of production could be maintained until essentially all of the recoverable oil was produced from the reservoir rock flanking the fracture.

From calculations supporting Figs. 4 and 6, it may be seen that the deeper the fracture, the higher will be the ultimate recovery and, furthermore, the oil can be recovered in a shorter length of time.

To further illustrate this, Fig. 7 shows cumulative production after 70 days versus the radius of fracture. The cumulative recovery was obtained by integrating the producing rate shown on Fig. 6. It can be seen that the longer the fracture, the higher will be the cumulative production. Calculations showed this to be true at all times after a brief initial period.

Field example . . . To illustrate the effect of deep fractures in tight formations, the following field examples are given:

Wells "A" and "B" were open-hole completions producing from a very tight formation with permeability averaging .2 to .4 md. Both wells had been acidized on initial completion, but the rate of production after several years had declined to about 2 bbl. per day and both wells were fractured to stimulate production. Attempts to revive wells in this field by shooting, acid treatment, or small-volume hydraulic fractures had met with limited success.

Well "A" is a typical example of a well treated with a small-volume hydraulic fracture treatment. This well was treated with 30 bbl. of gelled hydrocarbon containing only 0.16 lb. of sand per gallon of gel, and an effective

fracture radius of less than 25 ft. is believed to have been achieved. The rapid decline of producing rate when this well was placed on production is shown on Fig. 8 Approximately 2 years were required to pay out the cost of this treatment.

Several years later Well "B" was treated with 200 bbl. of No. 5 fuel oil containing approximately 1 lb. of sand per gallon. This was 7 times as much fluid and 40 times as much sand as used for Well "A." An effective fracture radius of approximately 100 to 200 ft. is believed to have been achieved. A relatively high production rate resulted and the cost of this treatment was paid out in 6 days.

The actual production performance of both wells follows the pattern which would have been indicated from Fig. 6.

Creating deep fractures . . . The engineering involved in creating and placing such fractures is not by any means routine and is beyond the scope of this paper. However, in very tight formations where deep fractures are beneficial, it is almost a certainty that large fracture radii are obtained if enough fluid and propping agent are injected.

The estimated volumes of low penetrating fluid required to achieve the fracture radius needed in these tight formations are shown in Table 1.

TABLE 1

Bbls.* of fracturing fluid	Radius (ft.)
20- 40	100
200- 400	200
500- 800	400
1000-2000	600

*With 1 lb./gal. sand added.

Some special factors . . . While this type of development appears promising, a number of special factors should be considered.

1. Impermeable stringers in the producing section should be located. These limit the volume of the reservoir that can drain vertically into a fracture extended through any one permeable zone.

2. It must be determined that there is adequate gas in solution with a bubble-point pressure high enough to provide reasonable productivity and recovery.

3. Reservoir samples of oil should be collected at as near initial conditions as possible and analyses made to determine the size of particles that are present initially or might be precipitated during pressure decline and gas evolution.

4. Formation cores should be studied and tests performed to evaluate both horizontal and vertical permeability, both as to air (as normally reported) and relative permeability, both with true fluids and reservoir oils containing suspended particles if such is characteristic of the field in question.

5. A fracturing process should be selected which would permit maximum transportability of the propping agent and minimum fluid loss to the formation.

6. The fracturing process should be so conducted as to have maximum assurance of achieving a fracture parallel to the bedding plane and located as nearly as possible in the center of the producing section.

A precautionary note . . . Deep fractures offer the most logical means of well completion in very tight formations. However, caution should be exercised in using them in more permeable reservoirs where water flooding, natural or artificial, might be employed. While a deep fracture in the tight reservoir is necessary, it would cause severe channeling where water is the driving fluid. Fortunately, in such reservoirs, fracture penetration of 10 to 50 ft. is adequate for well productivity requirements.

Underground Storage

(Continued from page 81)

second well, which operation proved very successful in all respects. The development of the U-tube principle with regard to installation and operation of underground facilities is of paramount significance. It provides a means whereby underground storage can be satisfactorily developed in salt sections of poor quality.

At the present time it is planned to U-tube Wells Nos. 2 and 3 as soon as stored products are withdrawn.

Well No. 4, which was drilled in March 1953, was completed in a manner different from Wells Nos. 1, 2, and 3 as the result of operating experience. To circumvent operational difficulties occasioned by caving of stringers in the storage cavity, the well was completed in a stratum of substantially pure salt extending 32 ft. above the base of the salt section and directly below a bed of anhydrite 25 ft. in thickness to isolate the upper portion of the salt section mainly responsible for difficulties incurred to date. As of this date, this well has been leached to a capacity of approximately 52,000 bbl. with only one cave-in of a serious nature occurring. This occurrence was the result of shelving of a portion of anhydrite overlaying the storage cavity. Remedial work consisted of redrilling the hole in the storage cavity and installing a liner to serve as protection for the tubing string. It is probable that this workover operation will remedy difficulties experienced, but in the event that a reoccurrence is experienced, conversion to a U-tube-type installation will be effected.

Brine Storage Pit

The only item involved in the total underground storage installation which is not conventional with regard to oil field and gasoline plant operation is the type of brine storage pit employed. It is essential that the large volume of brine solution being handled be confined and storage facilities be so constructed that seepage will not result which might be injurious to farm lands, livestock, streams, and lakes. To provide for the most economical type of brine storage, earthen pits lined with a membrane of asphalt manufactured by a catalytic oxidation process have been employed. In constructing brine-storage pits of this type, it is necessary to provide for a maximum slope on the four walls not to exceed a ratio of 3:1. This provision is necessary to eliminate any possibility of the asphalt membrane becoming detached from the walls of the pit due to gravity and wave action upon the asphalt membrane during periods of maximum fluidity during the hot summer months. Phases in the construction of the type of pit employed in Lion Oil Co.'s installation are:

1. Excavation necessary to provide pit capacity and in conformity with design specifications.

2. Preparation of the storage-pit surface to provide a suitable base on which to apply the asphalt membrane lining. This operation involves compacting, grading, and rolling of the surface to the extent that pit base levels do not exceed a tolerance of ½ in. and the pit surface is dry and sufficiently firm to withstand design hydrostatic head.

3. Priming pit surface with a coat of medium curing cut-back asphalt.

4. Application of catalytic asphalt sufficient to provide a membrane lining of ⅜ in. minimum thickness.

5. Covering of membrane lining with earth of not less than 6 in. in depth to secure lining, as well as prevent damage from wave action.

Operating experience has indicated that the type of pit now being utilized has been very satisfactory in that no failure has occurred due either to construction or type of materials employed. A failure of the lining in one pit has resulted from ground water seepage in the pit area. This condition resulted in an external hydrostatic pressure in excess of that being exerted on the asphalt lining by contained brine, which resulted in a rupture of the lining. To relieve this situation, it was necessary to install adequate tile drainage to divert ground water seepage away from the pit area.

Need a mathematical wizard for tough problems . . . ?

Put the Automatic Computer to Work

Here's how Humble used it on a specific job—that of calculating flow on a number of streams during F.C.C. plant tests

by F. M. Orr

THE automatic computer can be used to advantage in a number of refinery applications, such as:

1. Workup of test data from plant and pilot units.
2. Calculation of plate-to-plate multicomponent distillation problems.
3. Economic studies, such as proper processing schemes for new stocks, payouts on new equipment, etc.
4. Calculation of mass-spectrometer analyses.
5. Yield and quality calculations on various process units.

This article presents details of application of the computer to a specific problem in the first category—exact calculation of flow in a number of streams during a plant test on the fluid catalytic cracking units at the Baytown refinery of Humble Oil & Refining Co. Use of the computer in this instance proved economical, efficient, and time saving.

In addition to the common mathematical functions of addition, subtraction, division, and multiplication, the computer calculates logarithms and similar functions by series expansions. Graphs and tables may also be transferred to card tables, and the computer is able to pick up a tabulated value or obtain a proper reading from a curve during a series of calculations.

When computers . . . Using an automatic computer is usually not justified for the solution of a problem a single time, since it takes as long or longer to set up and work out the procedure for the computer as it does to work out the problem by other methods. As a matter of fact, it is usually desirable to have one set of results calculated by hand to check the results from the program.

Problems which should be considered for machine computation should have some feature in which a number of repetitive operations are involved, such as multiple use of constants and basic data, use of the over-all calculation procedure a number of times, or use of the same calculation sequences a number of times in a given problem.

Author is associated with Humble Oil & Refining Co., Baytown refinery, Baytown, Tex. Paper presented at ninth annual symposium on Instrumentation for the Process Industries, Texas A. & M. College, January 27-29, 1954.

Computer application . . . The problem to be adapted for computer solution is broken down into a series of steps, in much the same manner as is done when manual solution is employed. This series of steps is called a program. A set of standard punched cards incorporating these steps and coding the data and information for machine usage is then worked out. This set of cards is called the program deck.

The problem of computing fluid flow is well suited for computer application, since once master decks are prepared for calculating meter coefficients, they can be reproduced on auxiliary equipment as many times as necessary to calculate flow rates for all flowing streams. In addition, the complete test workup program could be used to calculate any test results for this unit by simply changing the data cards. One of the big advantages of putting this problem on the machine was that a test workup could be run off in about 20 minutes once the data were available and the data cards punched. Since the program could be prepared in advance, the test workups could be calculated within a few days after obtaining the data.

Meter coefficients . . . As a result of difficulties in obtaining good weight balances on the plant units in the past, approximate methods for calculating meter coefficients were considered unreliable for test calculations, and the rigorous method proposed by Stearns, Jackson, Johnson, and Larson in "Flow Measurement with Orifice Meters" had been used for several years. It was decided to continue to use this method; the equations used are shown in Table 1.

Rigorous calculation of a meter coefficient becomes a tedious job. First a Reynolds number must be assumed to calculate a discharge coefficient, K, using the equations shown in the table. The meter rate must then be calculated from which a new Reynolds number can be obtained and the procedure repeated with the new value. This trial-and-error procedure is continued until the assumed and calculated discharge coefficients converge. Actually, the calculation can be simplified somewhat since K_n, A, and $1 + A\lambda e$ are constants for a given meter installation.

The next step was to prepare a master deck for calculating coefficients. The job of preparing this master deck was simplified by having equations available for calculating the coefficients; however, tables or graphs could have been set up in the form of card tables for the machine to search automatically. An externally wired general-purpose board was available for use on the computer, so it was not necessary to do any wiring on the machine. The machine solves problems using the general-purpose control panel in a manner similar in many respects to the way they would be solved using a desk calculator or slide rule.

The problem must be broken down into a series of simple steps, each one of which generally involves some arithmetic operation on one or two factors that have been introduced into the machine as data or obtained as intermediate results from previous calculations. The series of such steps required to solve a problem constitutes a program, and the set of cards which tell the machine what to do is referred to as a program deck.

To simplify and standardize the method of coding problems, printed forms are available on which the arithmetic operation to be performed and the data to be used are listed in the order in which the calculation is to be performed. Here it is necessary to know the coding used in wiring the control panel; for example, 01 stands for addition, 02 for substraction, etc.

In the Humble company, once a problem has been coded, key punching and verifying the program cards and oper-

ating the machine are handled by the machine accounting division. In this problem, since an approximate meter coefficient was known, two passes through the equation were sufficient to get convergence of the assumed and calculated discharge coefficients. About 78 cards were required for calculating liquid meter rates and 103 for gas streams; about 100 cards per minute can be fed to the machine.

Program selection . . . One problem that often arises is how much should be put on the machine. A program can often be made very general, but may greatly increase the size of the program deck. The ultimate saving in time must be considered to be sure that the increase in the size of the deck is justified. In this case lookup tables and charts could have been incorporated in the program for converting physical data to the form required in the equation; however, it was felt that this refinement was not justified. Typical listings of the material printed out in calculating liquid and gas-meter coefficients are shown in Table 2. Data fed to the machine are listed first, followed by the answers calculated by the machine.

Since some of the data required in calculating a meter coefficient are constants for a given meter installation, the decks were prepared such that only the first 10 items would be changed in calculating gas-stream rates and the first 8 in calculating liquid rates. The other data cards were coded such that they could be withdrawn from the deck and new cards substituted in the event that changes were made to the flow-meter installation.

The material that is printed out by the machine is left up to the individual setting up the program. It may or may not be desirable to see intermediate answers. In this example the discharge coefficients were printed for each pass through the solution to check the rate at which the assumed and calculated coefficients were converging; this was desirable to be sure that a sufficient number of passes had been made in the calculation.

Once the subprograms were available for calculating meter coefficients, preparing the remainder of the program was a relatively simple matter. The computer that is available at Baytown has two storage units capable of storing thirty-two 10-digit numbers and, in addition, there are eight counters which not only can store numbers but can retain cumulative totals. The program was set up so that the machine calculates a series of meter coefficients, storing each stream rate for subsequent calculation. In the event that a cumulative total is desired, such as in calculating percentages or checking weight balances, the answer can also be stored in one of the counters.

In this program the coefficients for air streams were calculated first to obtain the total amount of air available for regeneration. A subprogram was then employed to calculate the carbon-burning rate; this answer was stored for later use. Pertinent information was printed out during the course of the calculation as shown in Table 3. The feed and product rates were then calculated and stored. The weight balance was checked, and the last subprogram then calculated the desired yields and conversion on fresh feed. The breakdown used in calculating yields of various products is of course controlled by the analyses fed to the machine for each product stream.

Manpower reduced . . . One objective in setting up the program was to minimize the amount of technical manpower required to calculate the test results once the program was set up. With this in mind, printed forms were pre-

(Continued on page 90)

TABLE 1—EQUATIONS USED IN CALCULATING METER COEFFICIENTS FOR FLANGE TAP INSTALLATIONS

Gas:

$$\text{S.c.f./d.} = 27{,}120\ (D_2)^2\ \alpha\ KY\ L_1\ \mu_{60} \times \left[\frac{RP_1\ (G_m - G_s)}{MT_1\ \mu_1}\right]^{1/2}$$

Liquid:

$$\text{B./d.} = 5.28\ (D_2)^2\ \alpha\ KL_1 \times \left[\frac{R\ (G_m - G_s)}{a_f\ G_{60}}\right]^{1/2}$$

To calculate K:

$$K = K_\infty\ (1 + A\lambda)/(1 + A\lambda e)$$

where:

$A = D_2\ (830 - 5{,}000\ \beta + 9{,}000\ \beta^2 - 4{,}200\ \beta^3 + B)$

$B = 530/(D)^{1/2}$

$K_\infty = b + n\ \beta^4 + j + r$

$b = 0.5993 + 0.007/D_1$

$n = 0.364 + 0.076/(D_1)^{1/2}$

$r = S\ (\beta - 0.7)^{5/2};\ S = 65/(D_1)^2 + 3$

$j = E\ (\beta^4 - \beta)^{5/2} - Z\ (0.5 - \beta)^{1/2}$

$\beta^4 = 0.07 + 0.5/D_1$

$E = 0.4\ (1.6 - 1/D_1)^5$

$Z = 0.009 + 0.034/D_1$

Definition of terms:

- D_1 = inside pipe diameter, in.
- D_2 = orifice diameter, in.
- β = ratio D_2/D_1
- α = area multiplier allowing for thermal expansion or contraction of plate
- K = orifice discharge coefficient
- Y = expansion factor for compressible fluid flowing through orifice
- L_1 = pen reading
- μ_{60} = compressibility factor, 60° F.
- R = size of range tube, inches of water
- P_1 = absolute static pressure at the upstream pressure tap, psia.
- G_m = specific gravity of manometer fluid at manometer temperature
- G_s = specific gravity of sealing fluid at average seal-line temperature
- M = molecular weight of gas
- T_1 = absolute temperature of flowing fluid upstream of orifice
- μ_1 = compressibility factor at P_1 and T_1
- a_f = volume multiplier for fluid flowing
- G_{60} = specific gravity of fluid flowing at 60° F.
- R_e = Reynolds number
- K_∞ = orifice discharge coefficient when R_e equals $(1{,}000{,}000\ D_2)/15$
- λ = reciprocal of Reynolds number

TABLE 2—TYPICAL LISTING FOR GAS METER

BYPASS AIR FRA 20	
METER RDG	8.0000
MOL WT	28.9000
VISCOSITY	.0228
AREA MULTIPLIER	1.0034
SP GR MAN FLUID	13.5500
RATIO SP HEATS	1.4000
COMP MU 60 DEG F	.9990
COMP MU FLOW	1.0000
UPSTM PRESS	38.3000
UPSTM TEMP ABS	717.0000
COEFF DIV BY 1000	81.0000
PIPE DIAM	15.2500
ORIFICE DIAM	9.7740
BETA	.6409
RANGE TUBE	50.0000
DISCHG COEFF SC	.6645
COST A	3445.9200
1 PLUS A LAMBDA	1.0052
DISCHG COEFF K	.6627
FIRST PASS MM SCFD	15.2424
PRELIM COEFF MSCFH	79.3875
DISCHG COEFF K	.6610
METER RATE MMSCFD	15.2033
COEFF MSCFH	79.1839

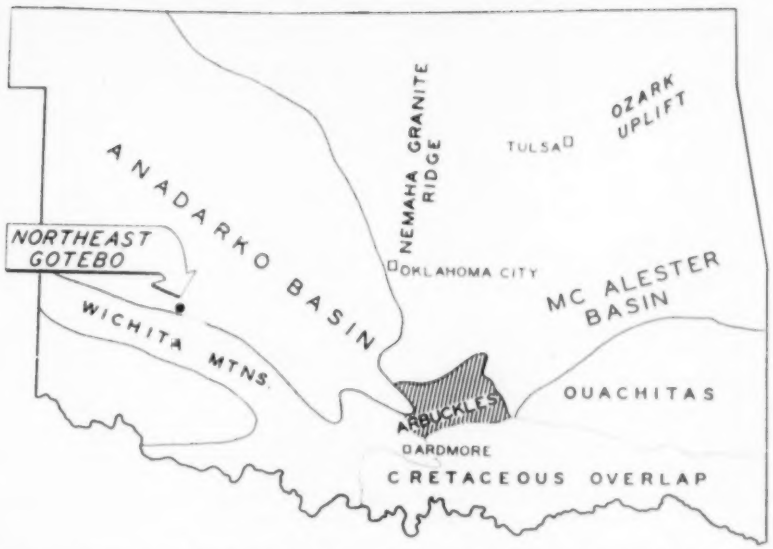
TYPICAL LISTING FOR LIQUID METER

FF TO T 1 TOWER	
METER READING	5.0900
SP GRAV 60 DEG F	.8944
VISCOSITY	1.0840
AREA MULTIPLIER	1.0037
SP GR MAN FLUID	13.5500
SP GRAVITY SEAL	.8855
DENSITY 60 DEG F	7.4480
VOLUME MULTIPLIER	1.1300
COEFF M BBLS PER D	1.1000
PIPE DIAM	4.0260
ORIFICE DIAM	2.8730
BETA	.7136
RANGE TUBE	100.0000
DISCHG COEFF SC	.7055
CONST A	1673.9900
1 PLUS A LAMBDA	1.0087
DISCHG COEFF K	.7073
FIRST PASS MBPD	5.5759
DISCHG COEFF K	.7074
METER RATE MBPD	5.5766
MM LBS PER DAY	1.7443

TABLE 3—TABULATED RESULTS FROM CALCULATING CARBON BURNING RATE

CALC CARB BURN	
TOTAL AIR MMSCFD	76.6139
M MOLS PER D AIR	202.1000
WATER TO DRY AIR	.0105
CARBON DIOXIDE	.0990
OXYGEN	.0170
CARBON MONOXIDE	.0820
NITROGEN	.8020
M MOLS D DRY AIR	198.7451
M LBS DAY CARBON	425.7540
M LBS DAY HYDROGEN	43.3952
M LBS DAY COKE	469.1492
WT PCT HYD IN COKE	9.2500
MSCFM AIR BURN C	34.6359
MSCFM AIR OXY DISP	13.6005
MSCFM EXCESS AIR	4.1962

TYPICAL OPERATION at Northeast Gotebo is this Zephyr Drilling Corp. drilling rig.



TECTONIC MAP of Oklahoma showing regional position of Northeast Gotebo field of Kiowa County on the north flank of Wichita Mountain uplift. (Fig. 1).

Drilling Along the Wichita Mountain Front

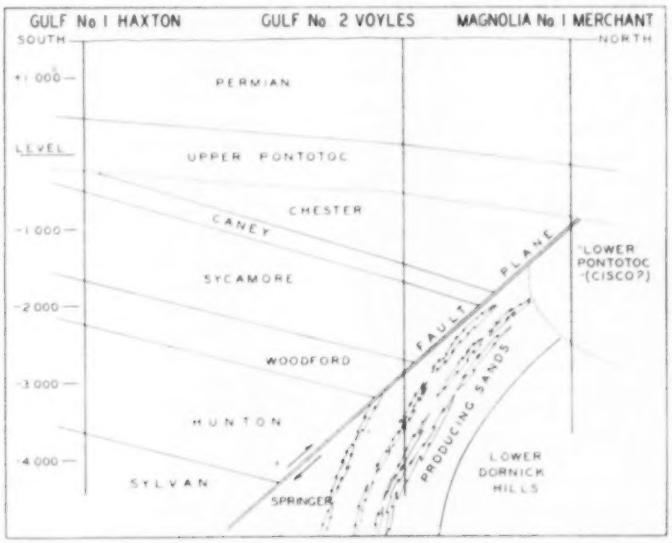
Good penetration rates achieved in highly tilted strata

by Joseph A. Kornfeld

SATISFACTORY drilling in highly tilted strata along the Wichita Mountain front in southwestern Oklahoma with good penetration rates has been accomplished by several drilling contractors in the search for oil and gas reserves in faulted Pennsylvanian Springer sands. (Fig. 1).

Oil and gas production is found beneath a typical mountain-front type thrust plane as shown in north-south cross-section (Fig. 2). In the immediate vicinity of Northeast Gotebo field, dips of strata lying above the thrust approach 30°, while dips of rocks beneath the thrust range from 60° to 90°. The area lies in the southern portion of the Anadarko basin near the geosynclinal boundary.

Dips as high as 80° have been observed with bore-hole deviations not greater than 4°. Generally, deviation does not exceed 1½° to depths of 3,500 ft. and 3° at depths below 3,500 ft.



MOUNTAIN-FRONT TYPE thrust plane shown in above north-south geologic cross-section has placed rocks beneath thrust at high angles. (Courtesy Richard Riggs, Oklahoma City). Fig. 2.

Cutting surface hole . . . A 9-in. bit is used to cut surface hole to 440 ft. A 13¾-in. reamer is employed in enlarging hole size for setting the 10¾-in. surface pipe. About 200 sacks of cement are placed behind the pipe.

Cutting deep hole . . . Shoe is drilled with 9-in. bit and this bit size is employed for making hole to contract depth in the Springer series. Permian beds extend for the first 2,000 ft. These comprise red beds, undifferentiated shales, sand, and limestones.

Practices employed to assure straight-hole drilling in highly tilted Springer beds found at Northeast Gotebo are:

- Reduction in weights on bit.
- Use of long-tooth rock bits.
- Use of drill collars.

The following discussion of drilling

practices in highly tilted Springer beds is taken from a case history of Stanolind Oil & Gas Co. and Zephyr Drilling Corp. 1 Hanza, NW SW SE 33-8n-16w, Kiowa County, Oklahoma, in the Northeast Gotebo area.

Days to drill . . . Rig was moved in on April 11, 1953, hole spudded April 16, 1953, and rig was moved out on June 15, 1953.

Contract depth of 6,500 ft. was reached in 52 days and total time expended on this well was 58 days. Only 10 days were consumed in drilling to 3,500 ft. while a total of 20 days were consumed in drilling to the major fault plane cut at 4,313 ft. Below the fault plane penetration was made at a generally uniform rate.

Hole-reaming operations, (exclusive of reaming after drill-stem tests) were made as follows above the fault plane.

Depth (ft.)	Reamed (ft.)
2,560	30
2,640	60
2,860	300
3,700	490

Reduction of weights on bit . . . In the upper portion of the hole from 3,500 to 5,000 ft., operators run a Totco survey at intervals as frequent as 30 ft. If survey shows bore hole is drifting away from vertical, weights held on bit are lowered. However, if the instrument shows bore hole to be drifting back towards vertical, weights are increased.

Principal deviation trouble was observed below 5,250 ft. in the Springer beds where deviation increased from 3° to 5°; lithology was shales, sandy limes and sand. Hole was straightened to 3° at 6,200 ft., and contract was completed with a deviation of 4°.

Long-tooth rock bits . . . Long-tooth shale bits have been employed with good results in drilling both the overhang and underthrust formations. Hard-formation rock bits are not used.

When shoe is drilled under surface pipe, crews make up eight 6¾-in. o.d. drill collars and a 9-in. bit. At a depth of 2,600 ft., the 6¾-in. drill collars are pulled, and six 6¼-in. o.d. drill collars are run into the hole.

As bore-hole deviation increases, not only is weight on bit lessened, but fewer drill collars are run. When the bit entered fault zone at 4,313 ft. in 1 Hanza, only five collars were on the drill string. Greatest difficulty with bore-hole deviation was logged from 5,300 to 6,300 ft. in this well and the number of collars carried reduced from six to three. Finally the hole was completed carrying only two collars.

Zephyr currently uses 6¾-in. o.d. drill collars all the way from beneath surface casing shoe to contract depth.

Bit Performance

A total of seventy 9-in. bits were employed in drilling to 6,500 ft. A 13¾-in. reamer was used to ream out 9-in. surface hole.

Above fault-plane . . . A total of thirty-two 9-in. bits were used in drilling from beneath the surface pipe to the fault plane at 4,313 ft.; this is an average of 123 ft. per bit. First bit run beneath the surface pipe cut 817 ft. of hole; and 265 ft. on the second bit. Bit performance was complicated by the rapid change in lithology and the high percentage of conglomerates and sands.

In the section from 4,000 to the top of the fault plane bit performance averaged only 43 ft. per bit in a 433-ft. interval.

Beneath the fault plane . . . In the interval from 4,313 ft. (where the well cut the fault plane) to 6,500 ft., (contract depth), thirty-eight 9-in. bits were used. This represents an average of 57 ft. per bit. Bit performance in this province can be highly erratic due to the rapidly alternating character of the Springer sands lying at near vertical positions. Performance ranged from as low as 9 ft. per bit (6,018-6,027 ft.) to as high as 175 ft. per bit (4,725-4,805 ft.).

Mud program . . . Water is used to drill with until a depth of 1,750 ft. is reached. At that depth, crews mud up and a 9.8-lb. 44-viscosity mud is carried until a depth of 2,800 ft. is reached. At this depth the caustic-quebracho mud is prepared with a weight of 9.4 lb. per gal. and a viscosity of 53 seconds A.P.I.

Typical mud summary is as follows:

Bentonite, sacks	610
Caustic soda, lb.	6,200
Quebracho, lb.	14,900
Soda ash, lb.	2,900

Viscosity is increased to 72 seconds A.P.I. at 4,500 ft. and this value was held to contract depth where the hole was finished carrying a 10-lb. mud.

Pontotoc red beds were logged to 2,266 ft. in Zephyr Drilling Corp. and Huffman and Malloy 1 Sophia Hanza, NW SE SE 33-8n-16w. Mississippian rocks were entered at 3,135 ft. and at 4,314 ft., an overthrust fault was cut and the bit entered Springer beds lying at near vertical position. (see Fig. 2.). A series of broken Springer sands were logged at 5,678, 5,750, 5,987, and at 6,108 ft. Hole was cut to 6,507 ft., total depth.

A series of drill-stem tests indicated gas-distillate sands from 5,682 ft. at various intervals to 6,106 ft. in the Springer section. Hole was plugged back to 6,200 ft. and 7-in. long string set at this depth. Casing was performed using a shot density of four shots per foot. A total of 488 bullets were shot opposite the following sand intervals: 5,692-5,706 ft., 5,736-5,748 ft., 5,990-6,030 ft., and from 6,050-6,106 ft.

A string of 2-in. tubing was set at 5,992 ft. on packer at 5,950 ft. using one joint of anchor. A Type A choke was set at 5,725 ft. and the well was dually completed with this equipment. The well was swabbed into production using fresh water to displace drilling mud.

On initial flow tests conducted through the annulus, first 12-hour orifice-meter gages, using ½-in. choke on top, was 2,170 M.c.f. of gas per day for the upper two zones; maximum shut-in casing pressure was 1,520 psig. On initial flow tests conducted through the tubing, first 12-hour test using a ½-in. choke on top, was 2,730 M.c.f. of gas per day on the two lower zones; maximum shut-in pressure on tubing was 1,480 psig.

Automatic Computer

(Continued from page 88)

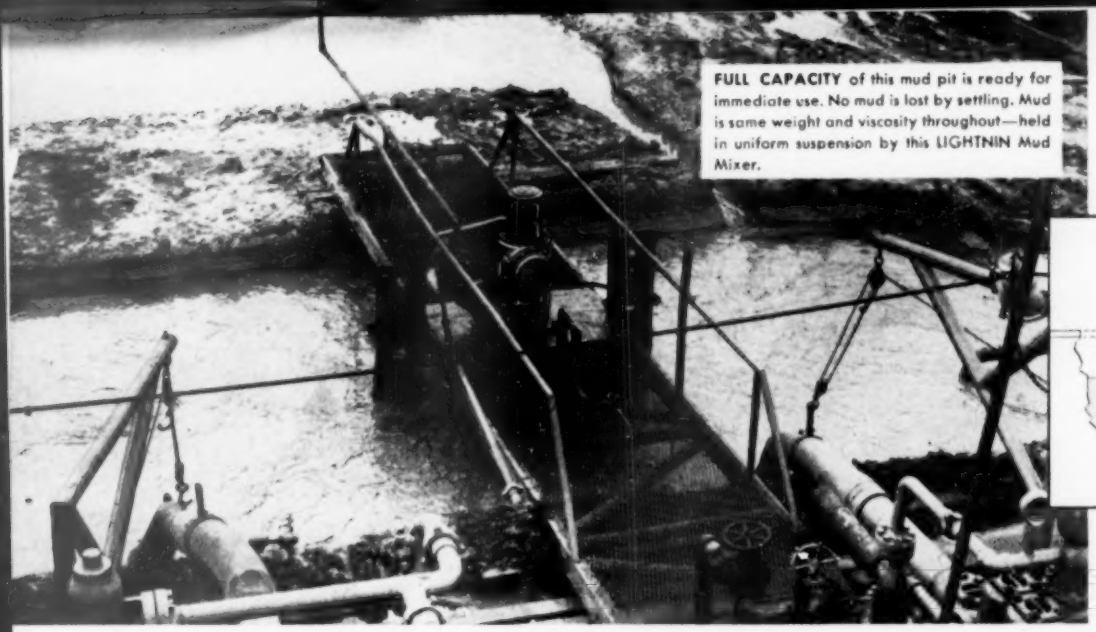
pared so that the data for a test could be listed and identified by a test number. Precoded data cards were also prepared with the data columns left blank. Upon receiving a listing of the test data, the accounting division personnel punched the data into the appropriate cards, merged the new data cards into the program deck, and ran the deck through the machine. The technical personnel were responsible for providing the necessary data and checking the results from the machine calculation.

At the present time, the machine calculation on commercial test workups has not been carried as far as that for the pilot-unit workups. There are two reasons for this; first, the process flow on the commercial unit is more complex and, second, fewer test workups are made on the commercial unit. On the pilot-unit workup, in addition to calculating a weight balance, conversion, and yields, other items are also calculated such as blending-gasoline qualities, reactor and regenerator velocities, stripping-steam rates, etc. An additional time-saving feature is the machine tabulation of data and results. Cards containing data and results are sorted into various groups corresponding to tables and printed in the usual tabular form with as many as five yield periods on one page. The table is reproduced for inclusion in the final report.

Other Articles on This Subject

The Electronic Age in Computing, The Oil and Gas Journal, pp. 57-80, February 2, 1953.

Automatic Computers Save Money and Technical Manpower, by W. M. Harp, Humble Oil & Refining Co., Baytown, Tex., Petroleum Refiner, April 1953.



FULL CAPACITY of this mud pit is ready for immediate use. No mud is lost by settling. Mud is same weight and viscosity throughout—held in uniform suspension by this LIGHTNIN Mud Mixer.

HEAVIER MUD is obtained almost instantly, by adding weight material through LIGHTNIN Flash Mixer in open-bottom well.

SAVE $67 out of EVERY $100 on upkeep of mud mixing equipment

Mix mud this new, faster, low-cost way that saves wear on pumps, valves, fittings

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This method—proved on over 100 U.S. rotary rigs—can save you as much as half or two-thirds the cost of replacing pump parts, valves, and fittings you now use for mud agitation.

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HEAVIER MUD—IN SECONDS. To get heavier mud, you dump weight material into a flash-mixing well as fast as you want—one whole sackful right after another. You get an *immediate* rise in weight throughout the whole mud system. A few seconds is all it takes to increase weight of every gallon of mud by the exact amount you want.

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Long-term results of use of

Corrosion Inhibitor in a Gas-Condensate Field

West Tuleta field, Bee County, Texas, is the site of what is believed to have been the first large-scale use of organic inhibitor for the protection of gas wells. Results of inhibitor use there, covering 7½ years, clearly confirm the benefits to be derived from the continuous use of properly selected and applied inhibitors.

by R. W. Dirks

THE application of organic inhibitors to West Tuleta field was first started in early 1946 by the operators of the unit in cooperation with Tretolite Co. and has continued to date. The experience of 7½ years in this pioneer project has shown:

1. Organic-type inhibitors give excellent protection in this field. Prior to injection of the inhibitor, tubing failures occurred at the rate of one failure for every 1,700,000,000 cu. ft. of gas produced. Since the treating program began, approximately 50,000,000,000 cu. ft. of gas has been produced without a tubing failure.

2. Once a protective film has been established on the tubing and surface fittings, only a very small amount of the inhibitor is necessary to maintain excellent protection. For example, 1 qt. of inhibitor per 28,000,000 cu. ft. of gas is being used in one well at the present time.

3. The inhibitor is easily applied. It has been found that batch injection gives as good protection as continuous injection and costs only a fraction as much.

4. In this field, the gathering lines going to the cycling plant have been satisfactorily protected without additional inhibitor being added.

West Tuleta field is composed of a 3,200-acre unit with five producing wells and one input well. Three of the wells, at present, are producing from the Slick sand in the Wilcox formation at about 7,500 ft., one is closed in, and one is producing from the Robinson sand which is also in the Wilcox formation. The gas is produced to a cycling plant where a portion of it is sold and the remainder is returned to the formation.

The bottom - hole pressure of the reservoir, at the time treatment began, was 2,950 psig. and the bottom-hole temperature was 230° F. The average flowing casing pressure was 2,250 psig. and the average flowing tubing pressure was 2,100 psig., with an average well-head temperature of 157° F.

The present average bottom - hole pressure is 2,660 psig. and the bottom-hole temperature is 230° F. The average flowing casing pressure is 1,930 psig. and the flowing tubing pressure is 1,890 psig. The average well-head temperature is 153° F.

The gas produced is typical of the Wilcox formation in this area, containing 2.19 per cent carbon dioxide and water at the rate of 2 bbl. per M.M.c.f. of gas. This water is fresh with a total solids content of 199 p.p.m.

History of corrosion . . . The produced fluids of the field have been found to be very corrosive. A major portion of the corrosive attack was found in the upper half of the tubing and the surface fittings. A brief summary of the corrosion history of each well, before treatment began, is given below:

1 Harris.—Prior to commencement of inhibitor injection, two tubing failures occurred in this well. On the first occasion the tubing parted before the unit operators realized that internal corrosion was present. This well was worked over and a new string of J55 tubing run. The well was off production for 27 days.

The tubing parted the second time about a year and a half after it had been put on production. New J55 tubing was again run in the well with a shut down time of 16 days. It was then produced for about 5 months before treatment was begun. The well is currently being produced from this tubing.

Various well-head fittings, such as wing valves and flange rings, were replaced frequently before treatment. Orifice plates and thermometer wells in the meter run were also severely attacked and had to be replaced as often as once or twice a month.

1 Robinson.—The tubing in this well did not fail but was removed in June 1949, to recomplete the well in another formation. Upon inspection of the tubing, it was decided to run a new string of J55 tubing in the well since the old tubing was badly corroded. The well was off production for 13 days.

After recompletion, no inhibitor was injected in the well from June 1949 until December 1950, at which time a hole developed in the tubing and jetted a hole in the casing about 700 ft. from the surface. The well was killed with mud. An attempt was made to pull out of the packer but was unsuccessful. The tubing was finally unscrewed at 4,600 ft. and pulled out of the hole. The casing leak was squeezed with cement twice before it held.

Six joints of the most severely corroded tubing were replaced and the tubing ran back in the hole and screwed into tubing which was still through the packer. The well was off production on this occasion for 21 days. Frequent changes of well-head fittings, orifice plates, and thermometer wells were necessary.

2 Robinson. — Two tubing failures occurred in this well before injection of inhibitor began. In August 1943, leaks developed in the tubing. The tubing was pulled and 13 joints were replaced. Three of these had holes in them. A second leak in the tubing occurred in January 1944. As the tubing was picked up, it pulled in two at 1,068 ft. The tubing was badly corroded and 20 joints were replaced. The well was off production for 10 days. Frequent changes of well-head and meter-run fittings were necessary.

1 Gingrich.—In October 1945 the 2⅜-in. upset tubing in this well was replaced with 2⅞-in. upset tubing. This was necessary due to the amount of gas to be produced. The well was off production for 21 days. The 2⅜-in. tubing was inspected and found to be badly corroded. The hang nipple was in very bad condition. Surface fittings on this well were also replaced often.

1 Perez.—Since a larger volume of gas was to be produced from this well, the 2⅜-in. upset tubing was replaced with 2⅞-in. upset tubing. Upon visual inspection, the 2⅜-in. tubing was found

Author is a consulting engineer, Tuleta, Tex.

TABLE 1—PRODUCTION AND CORROSION DATA WEST TULETA UNIT, BEE COUNTY, TEXAS

Well and period—	Cumulative gas production (M.c.f.)	Mechanical failures due to corrosion	Average iron content, p.p.m.	Type	Inhibitor used, avg. gal./yr.
No. 1 Harris:					
Prior to 1946	5,568,782	Two tubing failures. Tubing parted and had to be fished out. Replaced fittings on well head and replaced orifice plate frequently	322	None	None
1946 to 1953	15,510,379	None	28	K115, K118	56
No. 1 Robinson:					
Prior to 1946	280,899	None		None	None
1946 to 1948	7,400,761	None	59	K115, K118	121
Sept. 1949 to Jan. 1951	8,659,035	Replaced tubing, hole in tubing and casing	204	None	None
1951 to 1953	10,036,117	None	24	K224	84
No. 2 Robinson:					
Prior to 1946	3,906,079	Two tubing failures. Thirteen joints replaced in first failure. Tubing pulled in two in second failure. Replaced master valve, christmas-tree fittings, and orifice plates	210	None	None
1946 to 1949	6,227,172	None	53	K115, K118	104
1949 to 1952	6,227,172	None—shut in		None	None
1952 to 1953	6,256,979	None		None	None
No. 1 Gingrich:					
Prior to 1946	1,125,579	Replaced 2⅜-in. tubing with 2⅞-in. hang nipple in very bad condition, pitting in upset tubing	363	None	None
1946 to 1953	14,278,389	Replaced choke tip and seat	33	K110, K115, K118	84
No. 1 Perez:					
Prior to 1946	1,377,068	Replaced 2⅜-in. tubing with 2⅞-in. tubing, 2⅜-in. badly corroded. Replaced orifice plates.	605	None	None
1946 to 1953	13,743,923	None	29	K115, K118	54

to be severely corroded. Several wellhead and meter-run fittings were replaced.

Performance of Corrosion Inhibitor

Early in 1946 a test was conducted on an organic-type corrosion inhibitor* in the 1 Harris well. As a result of this field test, injection of the inhibitor was begun into all the wells in West Tuleta field. Iron analyses were run on the produced waters from these wells weekly from 1946 until the present.

The inhibitor was injected into the casing of the wells during 1946 and 1947 by means of pumps. The cost of upkeep on the pumps was so high that it was decided to use lubricators to inject the inhibitor. The protection obtained by batch treating the wells by means of these lubricators was found to be satisfactory. Very few repairs of the lubricators have been necessary.

The batch-type treatment has lowered the cost of treatment very materially. These costs, at present, are comprised of the cost of the inhibitor and a small amount of labor to put the inhibitor into the lubricators. No dollars-and-cents costs have been given here because labor records of the operation of the field have not been broken down and no charges have been made to corrosion control.

The 1 Harris well had produced 4,700,000 M.c.f. of gas at the time the second string of tubing was replaced. From then until December 31, 1952, it has produced 10,810,379 M.c.f. of gas without a tubing failure. No fittings have been changed on the meter run, due to corrosion, since 1946 and only a few small fittings on the well head have been replaced. The iron content of the produced water on this well has been reduced from 322 p.p.m. to an average value of 26 p.p.m.

Table 1 is the summation of the performance of this and the other treated wells in the unit.

Coupons were run in 1946 before inhibitor was injected and again after injection. The corrosion rate by coupon exposure was reduced from 0.0297 to 0.0029 in. per year†. The treatment on this well in 1950, 1951, and 1952 was an average amount of 13 gal. of inhibitor per year or 1 qt. of the inhibitor per week‡. The well is currently producing at the rate of about 4 million cubic feet per day.

The 1 Robinson well had no tubing failure until December 1950. This well was treated until June 1949, at which time it was recompleted in the Robinson sand. No inhibitor was injected from June 1949 until the tubing failure in December 1950 since it was necessary to pack off the casing.

Treatment was begun again in December 1950 with a stick-type inhibitor§. A total of 6,700,761 M.c.f. of gas was produced from this well from the Slick sand, while the tubing was being protected, without a failure. A total of 1,958,274 M.c.f. was produced from June 1949 until the tubing failed in 1950. Since treatment was resumed, 1,377,082 M.c.f. has been produced with no failures.

Treatment was begun on the 2 Robinson well in early 1946. From then until the latter part of 1948, when this well was shut in because the gas had become too dry, there was no failure due to corrosion in the tubing or surface fittings.

Regular monthly checks of the iron content of the produced waters have been made at the plant end of the gathering lines. This was done to determine whether or not the lines were being protected by the inhibitor which was being injected into the wells. It has been found that the lines have been protected satisfactorily. At the present time very little iron is being lost by the lines. These lines are 6-in. high-pressure pipe and are about 2 miles in length.

Dollar expenditure . . . For the period covered by this report, a total of $6,289 has been spent for corrosion inhibitor, injection equipment, and corrosion engineering in the West Tuleta unit. This figure does not include cost of labor to inject the chemical. By years the cost was:

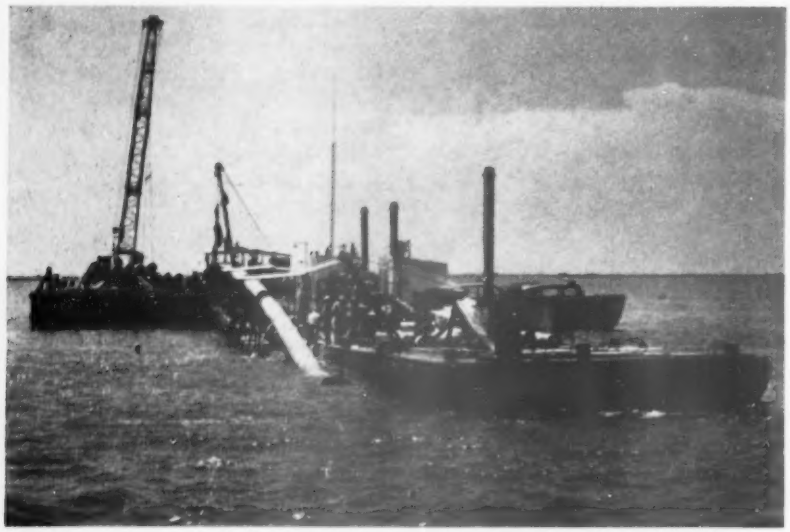
1946	$1,261.32
1947	2,253.94
1948	740.05
1949	398.55
1950	455.53
1951	849.51
1952	330.23

*Kontol 115.

†Justice and Jones, "Corrosion Inhibitor Test Harris Well No. 1 West Tuleta Field, Bee County, Texas." ‡Kontol 118.

§Kontol 244.

Pipe-Line Patrol



Concrete-coated pipe being laid in South Louisiana for Southern Natural Gas Co. Concrete coating was used extensively on this job.

Barite concrete is economical for pipe-line coating

ALTHOUGH the cost of barite greatly exceeds that of sand, its use as an aggregate for concrete can be justified from the standpoint of cost per pound of negative buoyancy attained. Barite concrete was used extensively as a weighting material by Southern Natural Gas Co. in their recently completed pipe-line system through south Louisiana and Mississippi. In addition to its value as a weight coating, the concrete protects the conventional coal-tar coating from attacks by all forms of marine life. *(For details of construction refer to The Oil and Gas Journal, January 18, 1953, page 105.)*

Southern Natural for Barite

1. Specifications for barite provide for a minimum specific gravity of 4.2, whereas that of sand is about 2.6. One sack of cement to four parts of barite will produce a concrete weighing 190 lb. per cu. ft. One sack of cement to four parts of sand produces a concrete weighing only 138 lb. per cu. ft.

2. The lightest mud in which lines were laid has a maximum fluid density of about 80 lb. per cu. ft. The negative buoyancy afforded by barite concrete is, therefore, 190-80 or 110 lb. per cu. ft. The negative buoyancy obtained from sand concrete is 138-80 or 58 lb. per cu. ft. As the ratio of 110 to 58 is almost 2, it is seen that barite is twice as effective when submerged as sand. In other words, in a fluid weighing 80 lb. per cu. ft., it will require twice as much sand concrete by volume as barite concrete to provide the same negative buoyancy.

3. Concrete coatings are applied in air and the pipe is handled in air. The heavier the coatings in air, the more difficult they are to apply. Heavier coatings also cause greater pipe deflections which result in greater internal stresses and tendencies to crack. Heavy coatings make pipe more difficult to handle and more likely to become damaged. Since twice the volume of sand concrete is required to provide the same negative buoyancy as barite concrete, the ratio of the weight of sand concrete in air to barite concrete would be 2×138 divided by 190 or $276/190 = 1.5$. Hence, the sand concrete coating would be 50 per cent heavier in air than the barite concrete coating and proportionately more difficult to apply, handle, prevent cracking, etc.

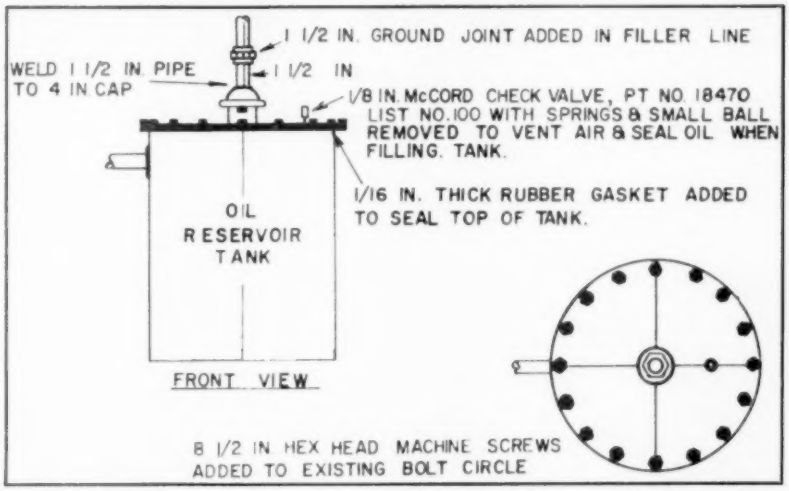
4. The cost of sand concrete in place is about 2.25 cents per pound. The cost of barite concrete in place is approximately 3 cents per pound. Since 138 lb. of sand concrete provide 58 lb. of negative buoyancy, the cost per pound of negative buoyancy obtained with sand concrete is $138 \times 2.25/58 = 5.3$ cents. On the other hand, the cost per pound of negative buoyancy when barite is used is $19 \times 3/110 = 5.2$ cents. Hence, it is seen that barite, although costing more per pound in place, is somewhat cheaper to use than sand.

5. The above computations are based on the lightest mud encountered in the areas traversed; similar computations for the heavier muds show correspondingly greater ratios favoring barites over sand.

6. Laboratory tests of strength, water-absorption ratios, and other qualities also indicate that barite is as good or better than sand concrete.

Blowers increase horsepower output

Air blowers installed on compressor intake air lines have increased horsepower output at Keystone main-line station No. 2 of El Paso Natural Gas Co. The units, each rated at 2,000 hp., were not delivering at rated capacity in the rarefied West Texas air. Each unit is now delivering some 2,020 hp. The station is located in the northwest corner of Winkler County, Texas.


1 1/2 IN. GROUND JOINT ADDED IN FILLER LINE
WELD 1 1/2 IN. PIPE TO 4 IN. CAP
1 1/2 IN
1/8 IN. McCORD CHECK VALVE, PT NO. 18470 LIST NO. 100 WITH SPRINGS & SMALL BALL REMOVED TO VENT AIR & SEAL OIL WHEN FILLING TANK.
1/16 IN. THICK RUBBER GASKET ADDED TO SEAL TOP OF TANK.
OIL RESERVOIR TANK
FRONT VIEW
8 1/2 IN. HEX HEAD MACHINE SCREWS ADDED TO EXISTING BOLT CIRCLE

CHECK-VALVE installation on station oil reservoir tanks to prevent overflow.

Check valve stops oil overflow

A SAFETY check valve developed by employes of Panhandle Eastern Pipe Line Co. prevents the overflow of oil from reservoir tanks during filling operation. As indicated on the drawing, the springs and ball are removed from a ⅛-in. McCord check valve and the assembly mounted atop the sealed oil reservoir. When the tank is being filled the valve acts as an air vent until the rising oil level floats the ball against the valve seat; it then acts as a positive check, preventing overflow. Air pressure used in filling can be left on the tank for an indefinite time after it is full.

This device was inspired by past instances of loss of hundreds of gallons of oil caused by employes forgetting to turn off air pressure after tank was full.

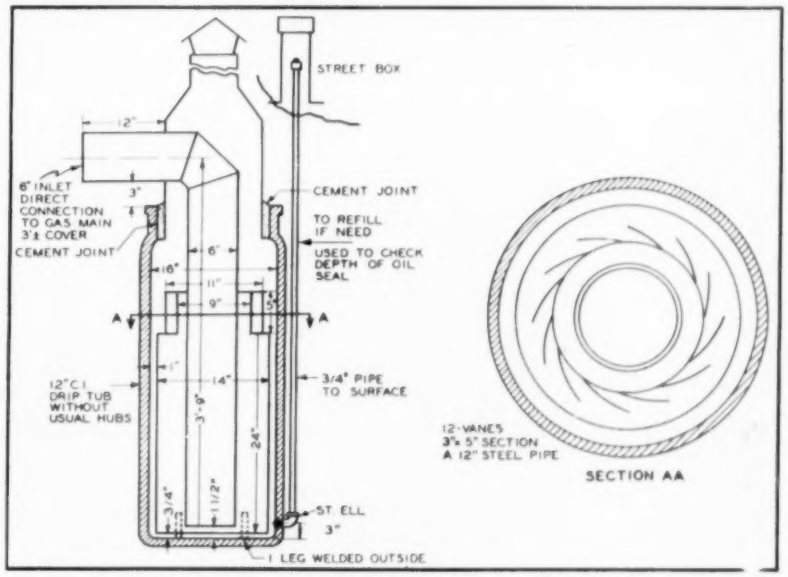
Codesigners are W. W. Osborne, assistant plant superintendent, and James H. Budden, Jr., engineer. (Reprinted from Panhandle Line.)

New gas-line seal-pot design

A NEW gas-line safety seal which prevents the loss of sealing oil is in use by Kansas City Gas Co., Kansas City, Mo. This seal, details of which are shown in the drawing, is connected near a district station pressure regulator; in case of regulator failure the seal will blow, preventing high-pressure accumulation in the distribution system, and will reseal when pressure drops. Previous seals have been of such design that oil would blow out; with the oil seal gone, gas would continue to blow, even after reduction in pressure, until such time as the oil could be replaced.

In the new seal the curved blades impart a rotary motion to the oil, separating it from the gas and allowing it to run back to the bottom of the pot. The reseal is effected as soon as pressure is reduced to normal. On a test the 6-in. size passed 18,000 cu. ft. of gas per hour at a pressure of 20-in. of water without loss of oil and sealed properly upon reduction of pressure.

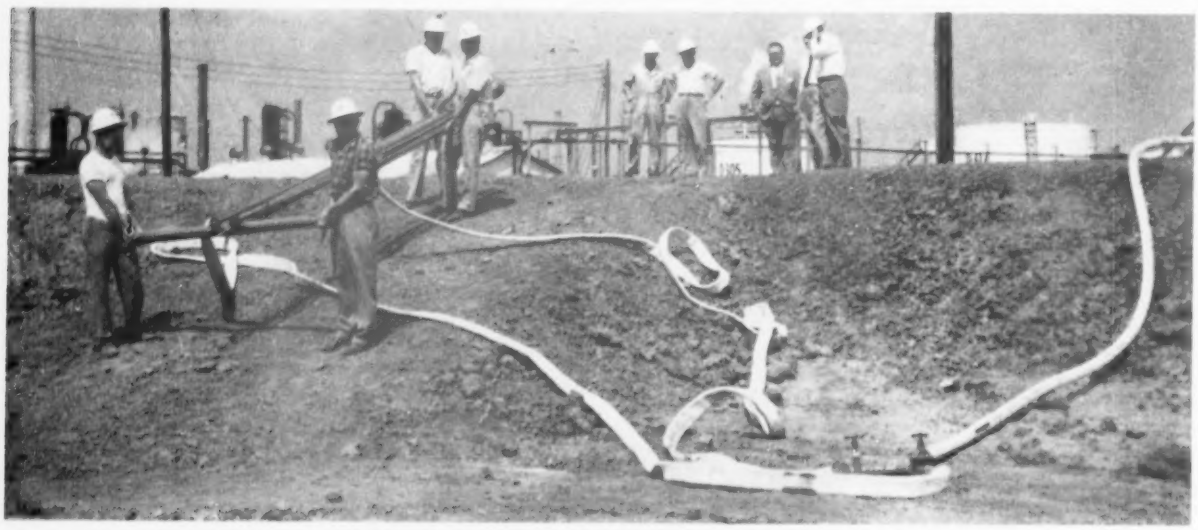
This equipment was developed by W. Musgrave Wood, of Kansas City Gas Co. (Reprinted from Natural Gas.)



CROSS-SECTION of oil-saving safety seal for gas distribution lines.

Unusual Housings For Fire Hose

THIS welded steel drum, is used by Tennessee Gas Transmission Co. to house fire hose at numerous points in station areas. The hose is spooled on a reel within the drum, thus being readily available in case of emergency. The drum also provides weather protection and prevents physical damage to the hose. In some cases, water lines have been extended to manifold and junction points some distance from the main plant and fire-hose installations similar to the one here have been provided to afford protection.



FOUR MEN, instead of a dozen, are carrying the applicator over the firewall. Hoses are for water and foam injection.

Manpower, time saved in fighting fires

A HYDRAULIC foam tower applicator in use at Shell Oil Co.'s Houston refinery uses less manpower and requires less erection time than previous methods.

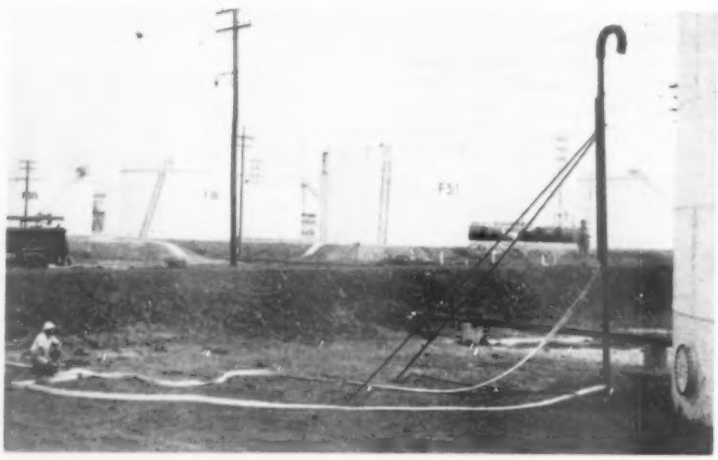
With only 4 men (as compared to 12) and in 3-4 minutes (as compared to 10-15) the tower can be raised into operating position, exclusive of hose assembly and connection.

The new fire-fighting system is a brainchild of L. J. Grossheim, manager of the fire and safety department, who worked with National Foam System, Inc., to develop it into its present form.

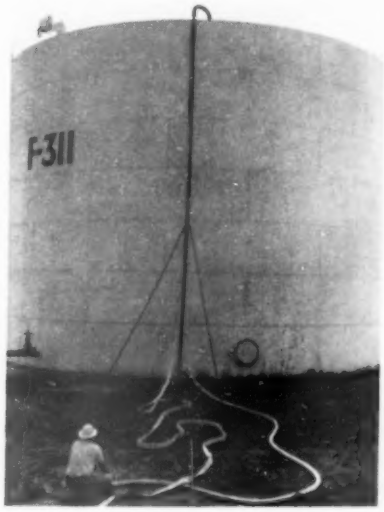
The tower consists primarily of a telescoping section, equipped with a

STARTING UP. Applicator is set in place and push poles are used to raise it vertically. Time is saved in not having to assemble a tower.

PART WAY UP. The push poles require but one man each and are extensible.



WATER TURNED ON. When water is turned into the applicator, hydraulic pressure raises gooseneck portion of the applicator.



IN POSITION. The gooseneck extends over the rim of the tank and foam turned into the applicator is distributed over the surface of the liquid within the tank.

gooseneck outlet for fitting over the edge of a tank, an inlet line for the foam, and supporting extension braces. These braces, or "push poles," are used to help carry the applicator and then used to push it into a vertical position, after which water is turned into the applicator and hydraulic pressure raises the gooseneck section. The push poles are extensible and connect to horizontal rods so they can support the applicator vertically.

As little as 35 lb. hydraulic pressure will raise the gooseneck section, which moves in a vertical position until the gooseneck clears the edge of the tank. The gooseneck is swung over the tank, the pressure lowered so the gooseneck drops back and locks in position. Foam turned into the system will then be directed over the surface of burning liquid.

Three factors make the foam applicator different from previous systems and these contribute to its effectiveness. They are:

1. Manpower saving . . . Initially it took 12 men with use of hands and push poles to assemble the sections and raise the tower. Now the tower is placed into position by four men and raised hydraulically. This manpower saving is significant, for the fewer personnel necessary to combat fires means a greater margin of safety for the plant proper.

2. Positioning gooseneck . . . When raising the tower by hand it would be difficult to get the gooseneck over the rim of the tank. Now the mere reduction of hydraulic pressure allows the gooseneck to settle slowly into position and lock so the foam will flow inside the tank and onto the liquid surface.

3. Capacity . . . The new apparatus permits use of a different type of foam from that previously used so that more gallons of foam can be applied per minute.

BOOKS

PRICE MAKING AND PRICE BEHAVIOR IN THE PETROLEUM INDUSTRY. By Ralph Cassady, Jr. Published by Yale University Press, New Haven, Conn. 353 pp. $4

This volumne, published under the auspices of the editorial board of the Petroleum Monograph Series, established by a grant from the A.P.I., presents the actual techniques of business rivalry. The author analyzes the nature of competition, the economic principles underlying competitive behavior, and the complex factors determining pricing at crude, refinery, tank-wagon, and retail levels. It is shown how individual companies operate in the attempt to wrest business away from one another, how opponents are chosen, how a price war is waged, and what legal problems enter into a system of competitive arrangements. The author is a professor at University of California, thus his work represents the findings of an outsider on the inside workings of a vital industry.

THE AMERICAN ECONOMIC SYSTEM. By Edwin Vennard and Robb W. Winsborough. Published by Row, Peterson & Co., Evanston, Ill., and White Plains, N. Y. 96 pp. $1.

This book is the outgrowth of experimentation in industrial economic education. It has been prepared for schools on the basis of ninth-grade use and is being offered as a supplementary text for high-school social-study classes in addition to its use as an employe-information tool for industrial-personnel activities. It tells briefly (1) how Americans started out to make a living, (2) how Americans won the highest standard of living, (3) how some American accomplishments compare with those of other countries, (4) how Americans share the national income, (5) why the American system has worked so well, and (6) what our American goals are and how we can reach them.

REFERENCE REPORT ON CERTAIN OIL AND GAS FIELDS of North Louisiana, South Arkansas, Mississippi, and Alabama. Vol. 3, No. 2. Prepared by Shreveport Geological Society, Box 750, Shreveport. 108 pp. $5.

This volume presents structure maps, cross-sections, and a discussion of development and production in 14 oil and gas fields in the titled area. It supplements the three previous volumes issued by the society.

THE TEXACO STORY—THE FIRST FIFTY YEARS, 1902-1952. By Marquis James. Published by The Texas Co., 135 East Forty-second Street, New York. 118 pp.

Here, in a handsomely printed volume, is the story of the growth of one of the world's largest companies from its beginnings as a small independent enterprise to its present role as a major integrated company with business activities throughout most of the world. With the aid of the company's public-relations staff, stories and legends of the early days were checked and evaluated, original documents were obtained, questions were asked and answered, facts sifted and compared. What emerges is a true story of an impressive era in our national history which should interest all who have a stake in the oil business.

GEOLOGY OF THE BRECKENRIDGE MOUNTAIN QUADRANGLE. By T. W. Dibblee, Jr. and Charles W. Chesterman. Published by State of California Department of Natural Resources, Division of Mines, Ferry Building, San Francisco. 55 pp. On request.

This report discusses the physiography, stratigraphy, structure, and geologic history, and mineral resources of the Breckenridge Mountain Quadrangle, which lies 20 miles east of Bakersfield, Calif. It contains 32 maps and illustrations.

GEOLOGY OF EEL RIVER VALLEY AREA, HUMBOLDT COUNTY, CALIF. By Burdette A. Ogle. Published by State of California, Department of Natural Resources, Division of Mines, Ferry Building, San Francisco. 45 pp. On request.

This report contains an abstract of the geography, stratigraphy, structure, geologica, geomorphic history, and economic geology of the area. It contains 20 illustrations, tables, and maps.

STRUCTURAL MAP OF OKLAHOMA. By Dr. Robert R. Wheeler. Published by Dr. Wheeler, consulting geologist, 3140 Amherst Street, Dallas. $27.50.

This map is based upon subsurface data derived from tens of thousands of wells across a region of 76,000 sq. miles. The map is contoured on the most significant horizons that the depth, abundance of wells, and contour spacing allow in each area. The map includes the area from Amarillo in the Texas Panhandle across Oklahoma to the Tulsa-Atoka meridian. All of Oklahoma's basins, uplifts, and platforms are indicated by name on the map.

PENETRATION CHARTS AND RESERVOIR DATA SUMMARY, Oil and Gas Fields in South Arkansas and North Louisiana. Prepared by Shreveport Geological Society, Box 750, Shreveport. $4.

This volume presents the geological and statistical data for 527 reservoirs in 250 oil and gas fields. The charts show the deepest depth penetrated, the production, and various other reservoir data for all the fields mentioned.

SPENDING FOR INDUSTRIAL RESEARCH, 1951-1952. By DeWitt C. Dearborn, Rose W. Kneznek, and Robert N. Anthony. Published by Division of Research, Harvard Business School, Boston. 103 pp. $2.50.

This study represents a "modest but very important investigation of the magnitude of industrial research activities" and "provides some of the basic quantitative information as to such activities, including the scale of expenditures for research and development by industrial firms by industry and by size."

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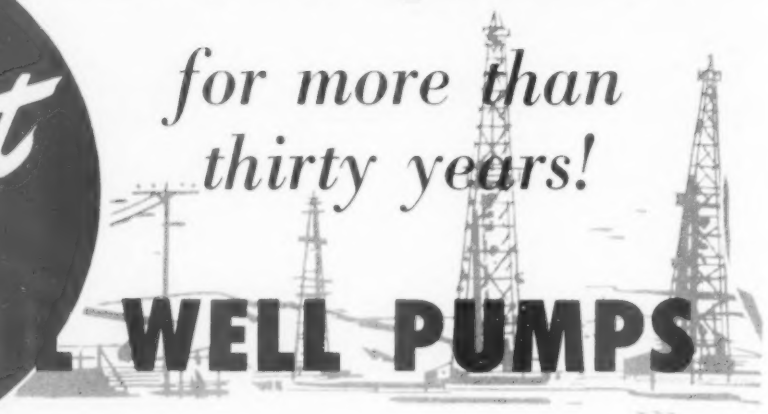

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Simplify Your Oil and Gas Calculations—9

by Louis J. Murphy
International Engineering Associates, New York

THREE charts for oil and gas heat-transfer calculations were presented in early installments of this series and examples were given for their use. Two charts were also given for spacing of valves in gas-lift installations and three charts for use in lube-oil dewaxing operation. Explanation of Charts 4 to 8, inclusive, is given in this concluding installment of the series.

Spacing Gas-Lift Valves

Charts 4 and 5 (January 18 and February 1) are a big help when spacing bellows-type flow valves in gas-lift installations. Chart 4 is for intermittent-flow installations where this type of flow is required because productivity is low, fluid level is low, or well depth is great. It is based on the usual 25-psi. decrement between successive valves in an installation.

Example . . . What distance should exist between the first and second valves in an intermittent gas-lift installation if the depth of the first valve is 1,600 ft. and kickoff pressure of the second valve is 775 psi.?

Solution . . . Enter on the left of Chart 4 at the kickoff pressure of 775 psi. and draw a straight line through the depth of 1,600 ft. for the first valve on the right. At the intersection with the central scale read the distance between the first and second valves as 1,475 ft. Therefore the second valve should be 1,600 + 1,475 = 3,075 ft. below the surface.

This chart is based on the relation:

$$S = 2p - fx/g$$

where:

- S = spacing between valves, ft.
- p = pressure rating marked on valve, psi.
- f = effective flowing gradient, psi. per ft.
- x = distance from next valve above to the surface, ft.
- g = static gradient, psi. per ft. of the fluid in the well to be unloaded (assumed to be 0.5 psi. per ft.)

Note that the depth of the first valve below the surface is found by using the zero point on the right-hand scale. In the above example, with a 25-psi. decrement between valves, depth of first valve is found to be 1,600 ft. by entering the chart at the kickoff pressure of 800 psi. (= 775 + 25-psi. decrement between valves). This chart is suitable for depths to 12,000 ft.

Chart 5 gives the maximum depth at which a bellows-type valve may be used for known values of the casing and tubing pressures, and flowing gradient in a gas-lift installation, which must flow continuously.

Example . . . What is the maximum depth at which a bellows-type valve may be used when casing pressure is 600 psi., tubing pressure 100 psi., and flowing gradient 0.10 psi. per ft.?

Solution . . . Enter Chart 5 on the left at the casing pressure of 600 psi. and draw a straight line through 100 psi. on the right. Then, from the intersection of the first line with the pivot, draw a line through the flowing gradient of 0.10 psi. per ft. on the right. At the intersection with the central sloping scale, read the maximum depth as 5,000 ft.

This chart is based on the relation:

$$D = (P - T)/f$$

where:

- D = maximum depth of valve for continuous flow, ft.
- P = casing pressure, psi.
- T = tubing pressure, psi.
- f = flowing gradient, psi. per ft.

It is suitable for all usual installations of bellows-type gas-lift valves where continuous flow is desired.

Refrigeration Required for the Wax Process

Three charts were presented to simplify computation of refrigeration requirements for production of cold-test oils by the wax process. They may be used in both design and production calculations.

Example . . . How much heat must be removed to cool 5,000 lb. per hour of oil 20° F. if the oil has a specific heat of 0.5 B.t.u. per pound °F.? What capacity refrigeration compressor is needed?

Solution . . . Enter Chart 6 (February 8) on the left at 5,000 lb. of oil and draw a straight line through the specific heat of 0.5 on the right. From the intersection with the pivot, draw a straight line through 20° F. temperature decrease on the left. Read the heat removed as 50,000 B.t.u. per hour, refrigeration tonnage as 4.15 tons.

This chart is based on the relation:

$$H = Wct_d \text{ and } T = H/12{,}000$$

where:

- H = heat removed, B.t.u. per hour
- W = weight of oil cooled, lb. per hour
- c = specific heat of oil, B.t.u. per lb., °F.
- t_d = temperature decrease of the oil, °F.
- T = refrigeration tonnage

12,000 = B.t.u. per hour per ton refrigeration.

Chart 7 (February 15) permits rapid calculation of the amount of heat that must be removed from the oil to congeal a desired percentage of the wax present.

Example . . . How much heat must be removed from 5,000 lb. of oil to congeal 10 per cent wax by weight if the wax has a latent heat of fusion of 120 B.t.u. per pound? What capacity refrigeration compressor is needed?

Solution . . . Enter Chart 7 on the left at 10 per cent wax removed and draw a straight line through 5,000 lb. of oil on the right. Then, from

Engineering Reference (Continued)

the intersection with the pivot, draw a line through the heat of fusion of 120 B.t.u. per pound on the left. Read the heat removed as 60,000 B.t.u. per hour, refrigeration tonnage as 5.

This chart is based on the relation:

$H = Wwh$ and $T = H/12{,}000$

where:

w = per cent wax by weight to be removed from the oil

h = heat of fusion of the wax, B.t.u. per lb.

Other symbols are the same as for Chart 6.

Note that if the percentage of wax to be removed is less than 10 per cent, the problem is solved in the same manner as described above except that the decimal point must be moved to the left in one of the chart values before entering. The number of places to point off depends on the wax percentage. For instance, if 8 per cent wax by weight is to be removed, solve as above, entering the chart at the point marked 80 per cent. Then move the decimal point one place to the left in the result.

Chart 8 (February 22) gives the final step in the calculation of the amount of heat to be removed from the wax and oil.

Example . . . How much heat must be removed from 5,000 lb. of oil if the quantity of wax to be congealed is 20 per cent by weight, the temperature decrease desired is 40° F., and the specific heats of the oil and wax are 0.6 and 0.5 B.t.u. per pound °F., respectively? What capacity refrigeration compressor is required?

Solution . . . This phase of the problem must be solved in two steps. Both can be performed on Chart 8. To find the heat to be removed from the oil, enter the chart on the left at 80 per cent oil (by weight) and draw a straight line through 5,000 lb. on the right. From the intersection with the heat stem, draw a line through the specific heat of 0.6 B.t.u. per pound °F. on the left. Then, from the intersection of this line with the pivot, draw a line through 40° F. temperature decrease on the right. Read the heat removed as 96,000 B.t.u. per hour, or 8 tons of refrigeration. Follow the same procedure for the wax to find the heat removed as 20,000 B.t.u. per hour, or 1.67 tons.

This chart is based on the relation:

$H = wWst_d$ and $T = H/12{,}000$

where:

w = percentage of wax or oil

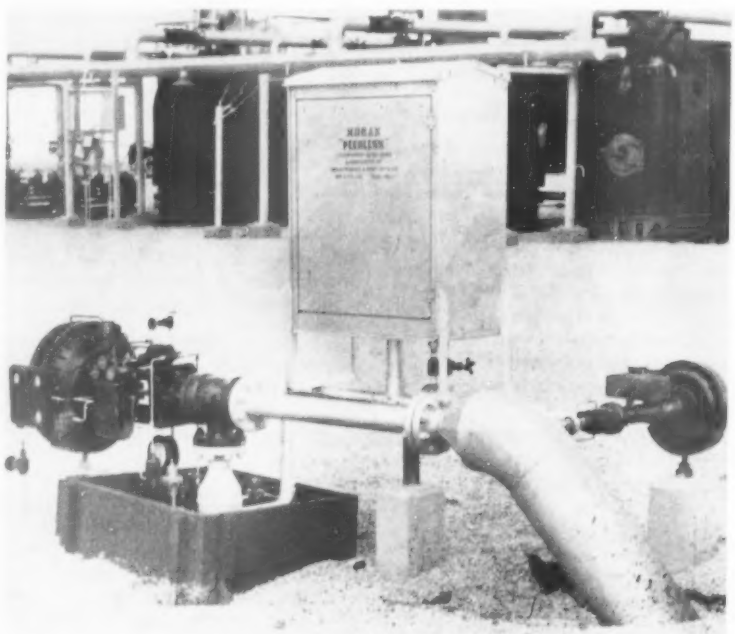
Other symbols are the same as for the two previous charts.

Note that Charts 6, 7, and 8 solve for the refrigeration tonnage required to (1) cool the oil to the temperature at which the wax will congeal, (2) congeal the wax, and (3) cool the oil and wax to some desired lower temperature. Total refrigeration tonnage required is the sum of the values in 1, 2, and 3, plus some allowance for leakage and heat gain. This is usually taken as 10 per cent of the total tonnage required.

Previous Installments

This discussion began in the December 14, 1953, issue, page 151. Other installments have appeared as follows:

December 28, 1953, page 99.
January 11, 1954, page 121.
January 18, 1954, page 115.
February 1, 1954, page 92.
February 8, 1954, page 137.
February 15, 1954, page 179.
February 22, 1954, page 189.



Reef Fields Dual Meter Runs

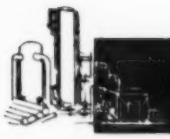
ACCURATE measurements of gas flared to atmosphere are made at Reef Fields Gasoline Corp.'s East Vealmoor plant by means of a dual set of meter runs.

The two meter runs are set up to operate over a wide range of gas volumes, with one to operate when the flare gas is less than 500,000 cu. ft. per day and the other to operate at flows greater than this figure.

Photo shows high-volume regulator valve on left and low-volume regulator on right. The low-volume meter run, consisting of a 2-in. line bypass around the high-volume regulator valve, is located downstream on the main flare line.

The low-volume meter run is equipped with necessary orifice, recorder, and regulator valve. When flare-gas flow begins, this low-volume regulator valve operates to permit gas flow through the 2-in. meter run. At the higher flows, however, the pressure drop is such as to open the regulator valve on the main flare line and the flare gas is then metered through the high-volume meter run located some distance upstream on the 6-in. flare line.

by R. J. Hull
and K. Raymond



How to Design and Evaluate Absorbers—13

THIS installment continues the example for an absorber test evaluation. A final installment, to appear in a later issue, will present the last chart to appear with the series, namely an equilibrium-constant chart for n-hexane.

Total mole fractions of components in the top section may also be obtained by the relation $y_{tD} = K_{tD}\, x_t$, using the actual discharge gas analysis to obtain y_{tD} for each component. It is interesting to compare the results of the two methods.

	y_{tD}	K_{tD}	x_t
Air	0.0666	79.0	0.0008
C_1	0.6125	14.4	0.0425
C_2	0.2508	2.20	0.1140
C_3	0.0701	0.68	0.1031
			0.2604

8. Compute quantity of liquid in the top section. In computing the quantity of liquid in the top section, it must be remembered that the term $1 - \Sigma x_t$ represents the mole fraction of normal lean oil, therefore:

$$L_t = 2{,}270/0.7377 = 3{,}077$$

9. Assume shrinkage, S = 950 M.c.f. per day, then:

$$(L/V)_{TOP} = \frac{3{,}077}{5{,}550} = 0.554$$

$$(L/V)_{BTM} = (1 + \frac{425}{6{,}500 \times 8})(\frac{2{,}407 + 950}{6{,}500})$$

$$= 1.008 \times 0.516 = 0.520$$

$$(L/V)_{AV} = (0.554 + 0.520)/2 = 0.537$$

10. Compute second trial shrinkage. Scale temperatures and (L/V) ratios according to Fig. 8. See Table 3. Computed shrinkage checks assumed shrinkage, therefore, no additional shrinkage trials are necessary.

11. Compute mole fractions of components absorbed in top section liquid, and from these compute top section heat of absorption.

	$y_{tG} \times (V_{tG}/V_{tG}) \times (1 - F)/K_{tG}$			$= x_t'$	$L_t x_t'$	M. lb. per day	B.t.u. per lb.	M. B.t.u. per day
Air	(0.0618)	(6,500/5,555)	(1 — 0.007)/79.0	= 0.0009	3			
C_1	(0.5436)	(1.170)	(1 — 0.033)/14.4	= 0.0427	131	5	77	385
C_2	(0.2665)	(1.170)	(1 — 0.223)/2.20	= 0.1101	339	27	158	4,266
C_3	(0.1281)	(1.170)	(1 — 0.665)/0.68	= 0.0738	227	26	155	4,030
								8,681

12. Top section heat of absorption per pound of lean oil = 8,681/1,033 = 8.4. From Fig. 3, $T_{tG} - T_{tO} = 19°$ F.; since $T_{tO} = 65$, T_{tG} (computed) = 84° F.

13. Using the above value of 8.4 B.t.u. per lb. of lean oil, the corrected T_{AV} = 97° F. as read from Fig. 6. Assume shrinkage, S = 925 M.c.f. per day, and proceed with final calculation.

Authors are with California Research Corp., Richmond, Calif. Paper presented at California Natural Gasoline Association meeting, Los Angeles.

14. Calculate component recoveries based on intake and discharge gas analyses (See Table 3) Component recoveries based on component differences in intake and discharge gases compare fairly well with computed recoveries. It is apparent that the analyses for air in either the intake or discharge gas, (or both), are in error; however, this does not affect the recoveries of other components seriously. An over-all tray efficiency for propane would not be reliable at a propane absorption factor of only 0.651.

15. If so desired, the heat of absorption per pound of total shrinkage may be computed by an over-all heat and material balance.

	Intake gas		Shrinkage		Discharge gas	
	M.c.f./day	M. lb./day	M.c.f./day	M. lb./day	M.c.f./day	M. lb./day
Air	402	32	3		399	32
C_1	3,533	150	119	5	3,414	145
C_2	1,732	137	356	28	1,376	109
C_3	833	97	450	52	383	45
	6,500	416	928	85	5,572	331

Molecular weight of hydrocarbon portion of discharge gas $= \frac{(331 - 32) \times 378.6}{5{,}572 - 399}$

= 22.0; air content 6.66 per cent volume or 9.73 per cent weight; $Cp_{tG} = 0.53$. Neglect heat-transfer effects into or out of column.

$$W_{tO}\, Cp_{tO}\, (T_{tO} - T_{tO}) + W_{tG}\, Cp_{tG}\, (T_{tG} - T_{tO}) + W_s\, Cp_s\, (T_{tO} - T_{tO}) = \Delta H_s$$

$$(1{,}033)\,(0.50)\,(84 - 65) + (331)\,(0.53)\,(78 - 66) + (85)\,(0.65)\,(84 - 66) = \Delta H_s$$

$\Delta H_s = 9{,}814 + 2{,}105 + 994 = 12{,}913$ M. B.t.u. per day.

$\Delta H_s/W_s = 12{,}913/85 = 152$ B.t.u. per lb. shrinkage (actual).

15. Compute heat of absorption per pound of shrinkage from individual component shrinkages:

	Shrinkage		
	M. lb. per day	B.t.u. per lb.	M. B.t.u. per day
C_1	5	77	385
C_2	28	158	4,424
C_3	52	155	8,060
	85		12,869

$\Delta H_s/W_s = 12{,}869/85 =$ B.t.u. per lb. shrinkage (calculated).

This result is a good check with the experimental result obtained by the over-all heat balance.

The results of the above sample absorber test evaluation are fairly representative of results obtained for many absorber evaluations. In most evaluations, the quantities of light solute in the lean oil are so low that their effects may be neglected and the evaluations are correspondingly simpler.

The sample evaluation is an excellent illustration of the importance of including the average absorber temperature in the calculation of component recoveries. The effective temperatures of absorption for the various components were obtained by scaling between the rich-oil temperature of 84° F. and an average absorber temperature of 97° F. In comparison, effective temperatures obtained by use of either the Edmister or Horton and Franklin methods would be between the lean-oil temperature of 65° F. and the rich-oil temperature of 84° F. As a result, calculated recoveries of ethane and propane would be about 10 per cent higher than shown in the example and agreement between actual and calculated recoveries would be poor.

References

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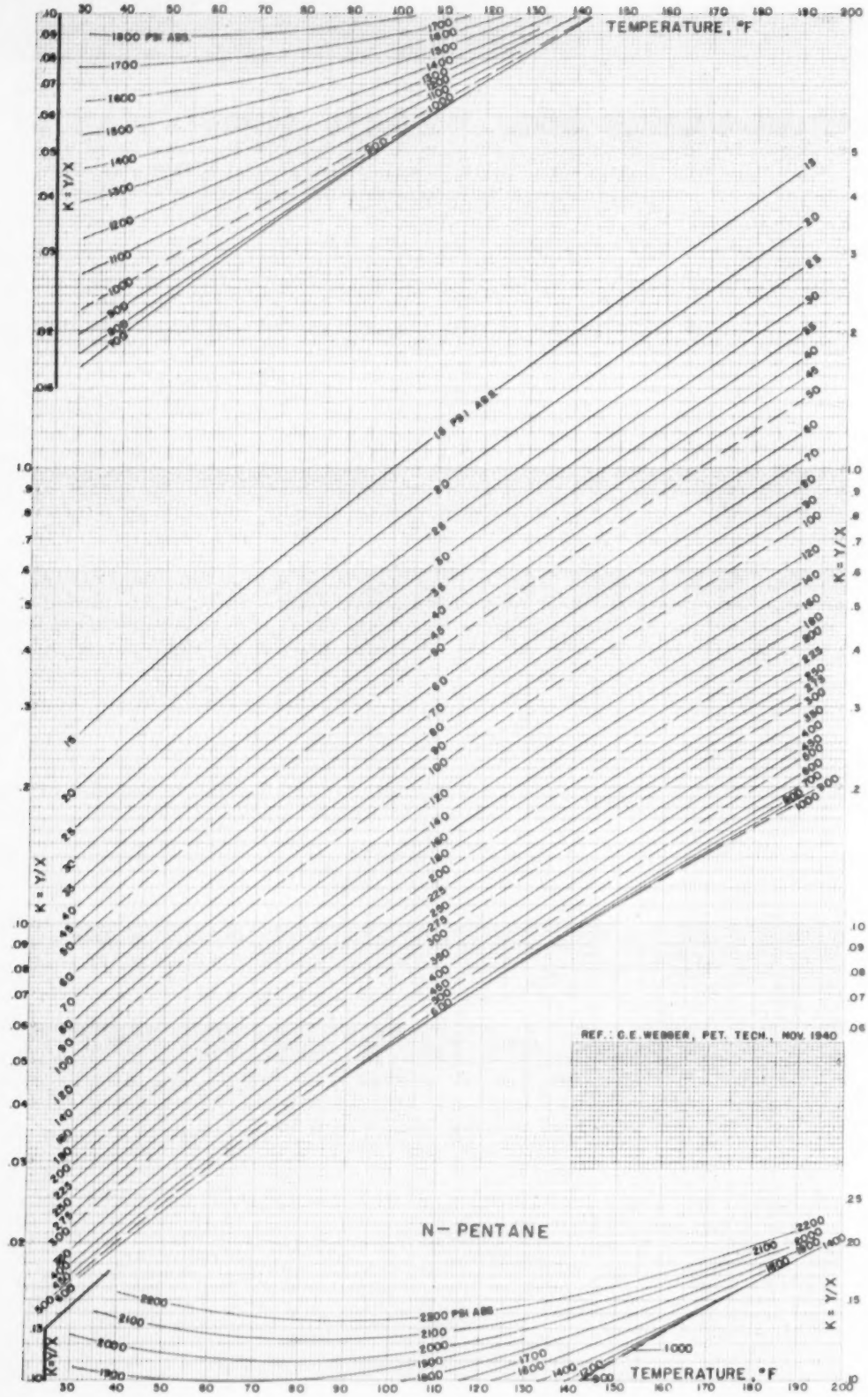

Equilibrium constants for n-pentane. Reference: C. E. Webber, Pet. Tech., Nov. 1940.

Applications of Outdoor Metal-Clad Switchgear—2

by E. R. Hoyle

THE stills-area substation No. 18A consists of two 3,750-4,685 kva. transformers, 11.5 to 2.4 kv. and 2.4 kv. outdoor metal-clad units assembled as a double-ended unit station. A circuit breaker is provided on each 11.5-kv. incoming feeder. This circuit breaker is located adjacent to its respective transformer. The 2.4-kv. unit consists of two transformer sections and six feeder sections. The 11.5-kv. incoming feeders have directional overcurrent relays and voltmeter for voltage indication. Included with the feeders are differential relays for transformer protection.

The 2.4-kv. feeders have phase overcurrent relays and an ammeter. Three of the feeders have a watt-hour meter. The transformer units have overcurrent relays and an ammeter. A voltmeter is included to indicate bus potential. (See Fig. 1.)

Crude-unit and straightrun fractionator substation No. 12 consists of 11.5 and 2.4-kv. outdoor metal-clad units and two 6,000-7,500 kva. transformers, 11.5 to 2.4 kv. The 11.5-kv. unit has two incoming feeder sections and two transformer sections. The 2.4-kv. switchgear consists of two radial units, each connected to a transformer. One unit has one transformer section, a bus tie section, and four feeder sections. The other has one transformer section and five feeder sections.

Phase and ground directional relays are provided on the 11.5-kv. incoming feeders. The transformer units have overcurrent relays for transformer protection. Each feeder and transformer unit has an ammeter. A voltmeter is included for bus voltage indication.

The 2.4-kv. transformer sections have overcurrent relays, differential relays, and an ammeter. A voltmeter is included for bus potential indication. The bus tie section has overcurrent relays and an ammeter. Each feeder section has overcurrent relays, ammeter, and watt-hour meter. (See Fig. 2.)

Author is electrical engineer, Sinclair Refining Co., East Chicago, Ind. Paper presented at A.I.E.E. meeting, Kansas City, Mo.

Equipment at Marcus Hook

At the Marcus Hook refinery, outdoor metal-clad switchgear at the main substation consists of six sections: two incoming feeders, two auxiliary, and two feeders to the fluid catalytic cracking area. The two incoming feeder sections are for preferred and emergency circuits from the local utility. One auxiliary section is used for utility company metering equipment. The other auxiliary section has potential transformers and relays for automatic transfer of preferred feeder to emergency feeder in the event of trouble.

Incoming feeders have phase and ground overcurrent relays and an ammeter. Feeders for fluid catalytic cracking area have phase and ground overcurrent relays, and an ammeter.

The substation at the catalytic cracking area consists of a double-end unit with two 2,000-2,300 kva. transformers, 13.2 to 2.4 kv. The 2.4-kv. section comprises two transformer sections and six feeder sections. Each transformer has an oil-immersed disconnect for isolating the incoming 13.2-kv. feeder. The disconnect is interlocked with the 2.4-kv. transformer breaker to prevent its being opened under load.

Each 2.4-kv. transformer section has directional relays and an ammeter. A voltmeter is included for indicating potential on transformer. Each of the six feeder sections has overcurrent relay, an ammeter, and watt-hour meter.

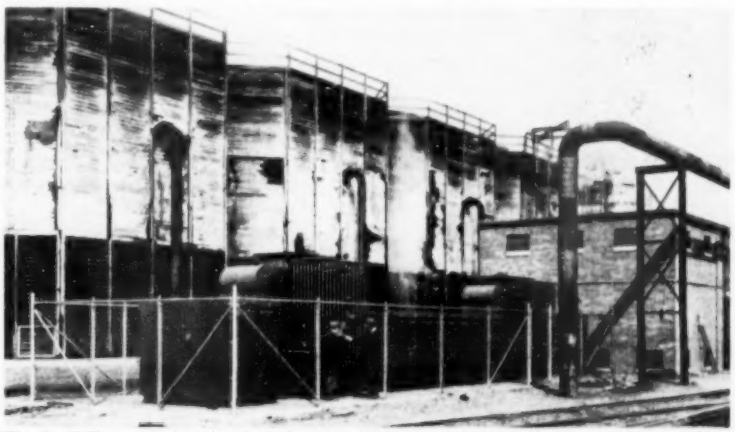

Fig. 1—Stills-area substation includes two outdoor metal-clad units assembled as a double-ended unit station.

Fig. 2—Crude-unit and straightrun fractionator substation includes 11.5 and 2.4-kv. outdoor metal-clad units.

PROGRESS IN METALS

Clad Plate and Linings

by W. L. Nelson
Technical Editor

CLAD steel is now available in at least the following types of cladding materials:

Silver	Aluminum
Nickel	L-Nickel (0.02% C max.)
Lead	Monel metal—67 Ni, 30 Cu
Copper	Inconel—78 Ni, 14 Cr, 6 Fe

Stainless:

- Type 304—19 Cr, 9.5 Ni
- Type 304 ELC—(same but 0.03 C max.)
- Type 316—17 Cr, 12.5 Ni, 2.5 Mo
- Type 316 ELC—(same but 0.03 C max.)
- Type 316 special—(columbium bearing)
- Type 347—18 Cr, 10.5 Ni, Cb 10 x C
- Type 405—12.5 Cr (Al 0.2%)
- Type 410—12.5 Cr
- Type 430—16 Cr

The corrosion and high-temperature resistances of the cladding materials need not be discussed here because they are the same as discussed heretofore for solid materials (Progress in Metals page, monthly since February 2, 1953). Nor is it necessary to discuss the physical properties of clad plate because it has been repeatedly demonstrated that properly fabricated clad plate exhibits no weakness at the bond between the two materials even when subjected to repeated bending operations, or heated and quenched through many cycles. Cladding does not seem to appreciably lower the thermal conductivity.

The resistant layer is usually about 10 per cent of the thickness of the plate but thicknesses ranging from 5 per cent to even 50 per cent can be supplied. In the case of soft materials such as lead, silver, or copper, the base metal substantially reinforces the softer clay layer. American practice indicates that the use of clad plate is economical at plate thicknesses exceeding ⅜-½ in., whereas the British feel that thicknesses greater than ⅞ in. justify cladding.

The fabrication of vessels from clad steels requires a double welding job and the welding of the inner or resistant material usually requires a special technique. In addition, the scrap loss is larger with clad steels and the plate must be handled carefully in the shop to avoid damage to the somewhat thin cladding. All of this leads to a fabrication cost that is about double. Thus far, clad nozzles are not available and it is therefore necessary to use solid connections or to line the nozzles with the cladding material. The liner is brought over the face of the flange and the flange face is machined to a smooth surface. The total cost of an installed lined nozzle is very high, ranging from 35 to even 100 per cent more than a carbon steel nozzle. In summary, the cost of clad constructions involve:

1. Cost of clad plate (see Table 1).
2. Basic fabrication cost (carbon steel total installed cost less 3-6 cents per pound for steel).
3. Extra welding, shop burden, etc.—about 100 per cent.
4. Extra cost of nozzles (35-100 per cent of cost of carbon steel nozzles).

TABLE 2—APPROXIMATE COST OF TYPE 410 STAINLESS LINERS

	Material and labor
5/64-in. thickness—shells	$8.40—12.50 per sq. ft.
7/64-in. thickness—shells	$9.10—13.00
Nozzle lining	36 cents/sq. in.
Nozzle face	53
Nozzle cover	42

TABLE 3—RELATIVE COSTS OF CLAD CONSTRUCTIONS*

	Ratio to carbon steel cost		
	Solid	Clad	Ratio of clad/solid
Exchanger, 18-8 Cr-Ni	6.1	5	0.82
Storage tanks:			
Monel	13.0	10	0.77
Monel (large)	5.5-6.0	4.1-4.9	0.74-0.82
Type 316 (large)	5.5-6.0	3.4-4.2	0.62-0.70
Type 316 (small)	6.5-7.5	4.4-5.0	0.67
Stainless	3.4-4.4	2.7	0.69

*Various references do not agree on total costs.

TABLE 1—APPROXIMATE BASIC COST OF CLAD PLATE (1951), CENTS PER POUND*

	Pure material†	Per cent cladding				Ratio to carbon steel (not incl. vessel fabrication)	
		5	10	15	20	Clad	Pure material†
Carbon steel plate	4-5						1.0
Nickel clad	88	29.0	33.0	37.0	41.5	6.4- 9.2	19.5
L-Nickel clad	95	30	35.5	41	46	6.7-10.2	21.0
Inconel clad	101	35.5	41.5	47	53	7.9-11.8	22.4
Monel clad	74	30	35	40	44.5	6.7- 9.9	16.4
Type 304	55		25		29.5	5.5- 6.6	12.2
Type 316	88		30		35	6.7- 7.8	19.5
Type 347	72.5		28		32.5	6.2- 7.2	16.1
Type 405	44		21		27.5	4.7- 6.2	9.8
Type 410 or 430	42		20.5		27	4.6- 6.0	9.3

*Plus extras for small quantities, large widths or long lengths, amounting usually to 3-8 cents per pound. †Estimated for purposes of comparison.

At thicknesses greater than about ¾ in., linings are a little cheaper than clad constructions. The cost of applying linings of the common 11-13 Cr variety, is indicated in Table 2. The cost of linings is little affected by the type of lining material because of the great amount of labor involved in applying the lining.

Finally, something of the feasibility of using clad constructions is indicated in Table 3 which shows for an exchanger and tanks, the ratios of the cost of such construction to the cost of solid construction or to carbon steel construction.

EQUIPMENT MEN . . . in the News

United Supply Transfers Huey and Gilbert

United Supply & Manufacturing Co., of Tulsa, has just announced the transfer of W. H. Huey from Dallas to its general office in Tulsa, and Clifford Gilbert from the South Texas area to Hobbs, N. M.

W. H. HUEY

C. GILBERT

Huey, who recently served as representative in the Dallas-Fort Worth area, has been promoted to an executive capacity in the general office at Tulsa. He joined United Supply at the Hutchinson, Kans., office and has been with the company over 12 years, except for 3 years in the service.

Gilbert joined United Supply at Stonewall, Okla., in 1940, and has served in several areas. In 1950 he was made district manager of the South Texas area. His new position as special representative at Hobbs is part of an increased sales program in that area.

Mud Products Enters Industrial Chemicals Field

Mud Products, Inc., has announced its entrance into the industrial - chemical supply business. Frank P. (Pete) Sanders has been appointed manager of the newly formed chemical division. The new division of mud products will handle a complete line of Solvay Process chemicals as well as other chemicals necessary to complete its industrial line, and will maintain warehouse stocks throughout the Mid-Continent area.

Sanders has been associated with the Solvay Process division of Allied Chemical & Dye Corp. as district sales manager in Oklahoma for the last 19 years. Prior to his association with Solvay, he was in charge of the chemical department of Texaco Salt Products Co., Tulsa, and had been associated 10 years with Hooker Electrochemical Co., New York.

Oilwell Names Snow to Drilling Equipment Post

The appointment of S. E. Snow as assistant manager of drilling equipment sales for Oil Well Supply Division of United States Steel has been announced by K. B. Winstead, assistant vice president, sales.

Snow, whose headquarters will be at Oilwell's home offices at Dallas, has a wide acquaintance in the oil fields, particularly in West Texas and New Mexico, where he has been associated recently with Carper Drilling Co. and Bosworth Drilling Co. For several years prior to his work with those two companies he represented Oilwell in the West Texas and New Mexico region.

P.E.S.A. Pacific District To Hold Spring Meeting

The Pacific District of Petroleum Equipment Suppliers Association will hold a spring membership meeting on Wednesday, March 24 at the Ambassador Hotel in Los Angeles.

Arrangements for the meeting are being handled by W. T. Powell, arrangements committee chairman; T. Sutter; J. L. Evans; and Otto Hammer, chairman of the board. A program consisting of talks by top-ranking executives of the oil and drilling industry is being planned.

Davis D. Bovaird, president of Bovaird Supply Co., Tulsa, and president of P.E.S.A., will attend the meeting.

Jorgensen Opens New Tulsa Steel Warehouse

Earle Jorgensen, president of Earle M. Jorgensen Co., has announced the opening of a new warehouse and sales office at Tulsa.

This new warehouse and plant will be under the management of D. E. Rodricks, who has been named Tulsa district manager for Jorgensen. Formerly assistant district manager of the Oakland, Calif., office, Rodricks has been with Jorgensen since 1934, when he started as a warehouseman.

Jorgensen's new Tulsa plant will serve all types of industry in Oklahoma, Missouri, Kansas, Colorado, and Arkansas. Complete stocks of carbon, alloy, stainless, tool, and special steels will be available for immediate delivery, in addition to complete stocks of aluminum.

Buda Announces Change In Distributor Setup

The Buda Co., Harvey, Ill., division of Allis-Chalmers Manufacturing Co., manufacturers of oil-field, industrial, and automotive engines and generator sets, has announced that its subsidiary, Buda Engine & Equipment Co., Inc., succeeds its former distributor, Buda Engine Sales & Service, Inc., in the states of Oklahoma and Kansas. The factory branch will be located at the same address in Tulsa.

Mid-Continent Makes Employe Awards

Sixty-three Fort Worth employes of Mid-Continent Supply Co. received gold and diamond service awards recently. Awards were presented by Mid-Continent President Ken W. Davis and Executive Vice President D. H. Thornbury. Individually honored was Vice President J. C. Halbert, who received a five-diamond award for 25 years' service.

Twenty-year service awards went to Davis, Thornbury, Assistant Secretary Jennie Hereford, and Director of Credits Frank John. Receiving 15-year service awards were N. E. Barber, W. J. Bierman, T. M. Cone, R. M.

Twenty-five years of service was recognized by Mid-Continent Supply with the presentation of a gold replica of the Mid-Continent trade mark filled with five diamonds to Vice President J. C. Halbert. Shown here are President Ken W. Davis and Halbert.

Flippo, H. W. Fuller, M. F. Heet, C. D. Helm, P. Z. Hilliard, R. O. Moore, H. E. Quinn, C. A. Sanders, B. C. Stewart, and T. P. Tarwater.

Ten-year awards were presented to Thurman Cline, M. F. Cribbs, Connie Housman, G. W. Jackson, J. C. McSpadden, H. D. Powell, B. H. Smyth, and W. E. Trammell. Thirty-seven awards were presented during the ceremonies to employes with 5 years' service.

Baldwin-Hill Advances Williamson to Area Manager

WILLIAMSON

David M. Williamson has been advanced to the position of area manager of industrial sales for Baldwin-Hill Co., manufacturers of thermal insulation. This was recently announced by Miles M. Wilson, general manager, industrial sales division.

In order to assume and carry out his additional responsibilities, Williamson will be located at the Baldwin-Hill plant at Huntington, Ind. The new area manager has been associated with Baldwin-Hill as district manager for over 6 years.

Welex Jet Announces Several Personnel Changes

Two personnel changes have been made recently in the Ardmore, Okla., district office of Welex Jet Services.

H. L. (Hess) Humphrey has been appointed district manager for Ardmore, replacing O. B. Avent, who became operations manager of Welex, stationed at the company's general offices in Fort Worth. Humphrey has over 18 years' experience in oil-field work.

In the second change, R. E. (Gene) Dixon was named sales engineer for Welex to work out of Duncan, Okla. Dixon has been with various oil-well service companies since 1936.

Kimray Names Distributors

Kimray, Inc., Oklahoma City, manufacturer of gas regulators and liquid-level controllers, has announced the following new distribution and service points: Merla Tool Corp., Shreveport, with Randall W. Larkin, manager; and Clif Mock Co., Beaumont, Tex., and New Iberia, La.

R. W. Elliott Announces Formation of Ace Products

R. W. (Ace) Elliott, of Houston, has announced the formation of Ace Products, a new company specializing in the manufacture and distribution of oil and gas-well production equipment and gas-lift devices. The manufacturing plant, which is already in operation, and headquarters of the new company are located in Houston.

Elliott is regarded as an authority in the field of production and control equipment, having served as sales and design engineer for the past 15 years with several of the industry's leading manufacturers of production equipment.

In addition to manufacturing, marketing, and servicing its own specialties, Ace Products offers representation to other manufacturers of production equipment on a complete sales and shop service basis.

Pacific Tube Adds Big Tube Drawbench

Another expansion in facilities has been announced by Pacific Tube Co., of Los Angeles. To meet western industry's increasing demands for steel tubing, the company has installed the biggest steel tube drawbench west of the Mississippi. The new 150,000-lb. bench will enable Pacific to draw steel tubing to a maximum length of 52 ft., with an o.d. as great as 6½ in. The drawbench itself is a single-chain, single-draw, double-mandrel rod, two-speed drive type. It has an over-all length of 121 ft., and its 400-hp., 230-volt d.c. motor can draw tubing at 100 ft. per minute. Its operation is almost entirely automatic.

Oil Center Appoints McDow As Sales Representative

The appointment of Harry N. McDow as a sales representative for Oil Center Tool Co., has been announced by Ross Spencer, O.C.T. sales manager. McDow's headquarters will be in Denver. McDow was formerly a salesman for Gulf Supply Co. and Rockwell Manufacturing Co., in Corpus Christi.

Puckett to Manage DuPont Pittsburgh District

Afton D. Puckett has been named manager of the newly created Pittsburgh district of E. I. du Pont de Nemours & Co.'s petroleum-chemicals division. He was formerly the division's sales representative in that city.

The Pittsburgh district is part of the eastern region, with headquarters in New York City. The new office will serve western New York, western Pennsylvania, and the State of West Virginia. It is located in the Alcoa Building, Pittsburgh.

Broderick & Bascom Expands Houston Factory

Broderick & Bascom Rope Co. has constructed this new addition to its Houston plant. The original Houston factory was constructed in 1950. Equipped with the most modern wire-rope producing machinery, facilities were designed to meet the needs of wire-rope users as of that date. However, increasing activity in the oil and gas, construction, industrial, and marine fields has created demands that necessitated construction of the new plant facilities. The Broderick & Bascom expansion will provide additional warehousing facilities as well as a multi-purpose shipping department with modern docks and equipment.

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Take the cost of a new 3x55 Goodall Rotary Hose with Barney Couplings	$1517.89
Add cost for furnishing and resetting couplings to make two 3x15 vibrator hose	250.00
Subtract normal cost of 2 new 3x15 vibrator hose @ 744.10	1488.20
Then, when the 2 sets of Barney Couplings used on the vibrator hose are returned, you are allowed a credit of $50.00 per set	100.00
NET COST TO YOU FOR 1 3x55 ROTARY HOSE **AND** 2 3x15 VIBRATOR HOSE	$ 179.69

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DIGEST OF NEW EQUIPMENT

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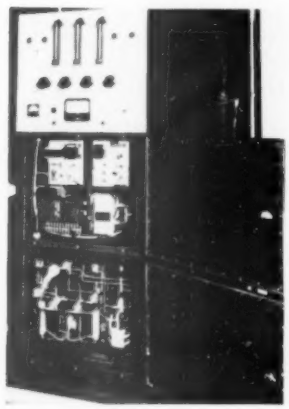
by Dan B. Miller

1 RADIOLOGICAL GAS ANALYZER. The instrument, designed by Shell Development Co., is adapted for continuous analysis of binary gas mixtures by measurement of ionization produced in the gas by beta radiation from a radioactive source. The radioactive source used is Strontium 90, because it is abundant and an inexpensive fission product with a relatively long half-life, and also emits only beta radiation, thus minimizing the shielding problem. It should be emphasized that the first installations have been for the measurement of argon in the converter gas in an ammonia plant. These installations have performed extremely satisfactorily. *Hallikainen Instruments.*



IT'S NEW ✓ CHECK IT

2 C-5 GATOR, a geophone clip, helps geophysical crews speed up time in making geophone connections. For use with the Vector split-spring cable takeout, the C-5 slip is designed to minimize costly field maintenance as well as assist operators in obtaining more accurate records. Its construction offers complete resistance to moisture, positive polarity identification, and freedom from breakage and subsequent field repair. Corresponding slots of different size on both takeout and geophone clip practically eliminate possibility of error in making quick connections. The clip automatically shorts when not on takeout, thereby affording electric damping protection to the geophone. In addition to its ability to work on small or large cables, the clip can be changed either in the field or by Vector, making it possible to reuse one as often as desired or replace a damaged one when necessary. *Vector Manufacturing Co.*

IT'S NEW ✓ CHECK IT

3 LONG-STROKE HYDRAULIC PUMPING UNIT allows the fluid to come in from the formation at its optimum rate, under conditions which approach very nearly to constant flow. This method is derived from an arrangement which allows down stroke speed to be varied independently of the upstroke speed. The optimum plunger speed might be such that the upstroke should be made in 30 seconds. This is set by the power-pump speed and displacement. The downstroke, in this case, could be set as low as 2½ seconds, by a simple adjustment at the cylinder. The advantages of long, slow strokes are: increased production, both ultimate and immediate; less sanding up, greater over-all efficiency; longer life; and lower maintenance costs, on both surface and subsurface equipment. The unit consists of a cylinder bolted to the well head, and a power unit, which includes a positive displacement power pump and a storage tank. *S. C. Carter Co.*

IT'S NEW ✓ CHECK IT

4 COSMALITE MICROBALLOON SPHERES. Microballoon is Standard Oil Co. of Ohio's trade mark for a recent development of its research laboratories. The product consists of extremely minute hollow spheres of phenolic resin with inert nitrogen gas. Their purpose is to reduce the evaporation of crude oil in storage tanks by forming a foam-like floating seal on the oil's surface. Normal evaporation losses average about 4 bbl. of crude oil for every

KEEP INFORMED ✓SAVE TIME ✓TEAR OUT CARD ✓CHECK IT ✓MAIL IT

This Digest of New Equipment offers you a quick resume of important features of new or improved products and trade literature and the opportunity to obtain complete information on each subject by use of the convenient "CHECK IT - MAIL IT" service card.

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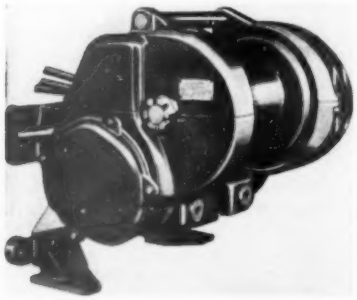
100 bbl. in storage tanks. Tests show that Cosmalite Microballoon spheres will cut loss to less than ½ bbl. for every 100 stored. In bulk, Cosmalite Microballoon spheres look like fine-ground dark flour. Under the microscope they resemble brownish ping pong balls. The particles are mixed with the crude oil and then pumped into the tanks. A rotary pump of 150 bbl. per hour capacity can install sufficient Cosmalite Microballoon particles to make a floating roof in about 3 hours. The phenolics that compose the spheres resist oils and many other chemicals and will not deteriorate and sink. *Colton Chemical Co.*

IT'S NEW CHECK IT

5 CARCO MODEL FO-1 ALL-PURPOSE WINCH for oil-field and pipe-line service features two speeds forward and two speeds reverse, and is designed to handle all the power of medium-sized industrial tractors like the Allis-Chalmers HD-9, International TD-14, D-6, and Oliver D crawler. The higher speed plus the high line capacity is provided for towing equipment over inaccessible terrain, mud, and across rivers. The line capacity is 292 ft. of 1-in. line. The slow speed with high line pulls make this winch ideal for spotting drill rigs and other jobs requiring long, steady pulls. The two speeds develop line pulls, with full drum, of 16,150 lb. at 172 ft. per minute in second speed, and 71,070 lb. at 35 ft. per minute, with bare drum, in low gear. *Pacific Car & Foundry Co.*

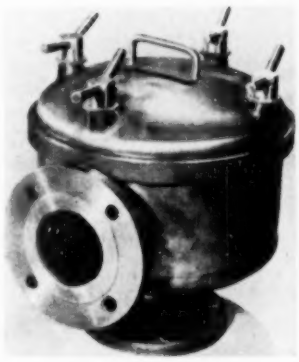


IT'S NEW CHECK IT

6 CENCOIL-B is for use in diffusion and fractionating pumps. The new oil, which is a highly purified, distilled-in-glass, di-2-ethyl hexylphthalate, when used in a single-stage, nonfractionating diffusion pump, produces a vacuum of the order of 7 by 10^{-6} mm. Hg at 250° C. without the use of a liquid air or charcoal trap. This oil is quite stable under normal conditions and permits operation at relatively high forepressures with low heat input. It is an excellent general-purpose oil, and especially suitable for use with the new Cenco Supervac pump OD-25. Its boiling point at 0.5 mm. Hg is 180° C., and its open flash point is about 380° F. *Central Scientific Co.*

IT'S NEW CHECK IT

7 LARGE MULTIPLE SURFACE FILTERS. Large-capacity filters have filter areas up to 720 sq. ft., and cake space capacity up to 35 cu. ft. Filter medium is high-temperature resistant porous stainless steel, and container can be either carbon steel or stainless steel for corrosive service. Compact design permits steam jacketing, high-pressure construction, and ease of cleaning. The accompanying photograph shows a filter with 30 sq. ft. of filter area housed in a stainless-steel container 12 in. in diameter by 20 in. long. Porous stainless-steel filter medium prevents "break through" point, or pressure above which clarity of filtrate is no longer obtained and is the perfect support medium for filter-aid, since it will not pass filter-aid during any portion of the filtration cycle. These filters are recommended for clarification service and solids collection in service with such fluids as water or petroleum products. *Micro Metallic Corp.*



IT'S NEW CHECK IT

8 TACCO TRUCK STAIR prevents injuries and cargo damage because it permits the driver to walk up and down stairs from the body instead of climbing or jumping. It eliminates torn clothing, fatigue, and injuries. For better traction when carrying packages, the step extends back from the truck body. However, it cannot be broken off or damaged if the truck is backed into a loading dock or wall because the stair is self-retracting and will fold back automatically upon contact. The all-welded stair is attached to the truck bed or cross frames by four bolts, or it may be welded in place. Nonskid treads keep feet from slipping. Over-all weight of the device is 50 lb. It is compact when folded, and when extended, the step protrudes only 14 in. from the back of the truck. Steps are 6 in. wide to assure secure footing. *E. D. Bullard Co.*

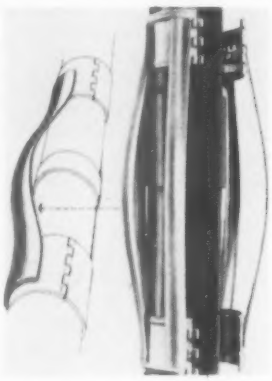
IT'S NEW CHECK IT

9 NEW VISI-TAB BLINDS AND SPACER RINGS FOR PIPE LINES are lightweight, lower-cost blinds and spacer rings for application in refineries, petrochemical plants, tank farms, distributing plants, and for pipe-line testing. Because Visi-Tabs extend beyond the pipe flanges, it is easy to identify whether the unit is a blind that is completely sealing a flow shutoff or a spacer ring that is pro-

viding an open flow. To further simplify ready identification, the blinds have blank disks at the end of the tab, while the spacer rings have an open ring at the end. There are sizes for all standard pipe lines, for raised face, ring-type joints, and tongue-and-groove flanges with a full range of A.S.A. service pressure and temperature ratings including 150, 300, 400, 600, 900, 1,500 and 2,500 psig. They can be furnished in carbon steel, carbon moly, chrome moly (to all A.S.T.M. plate and forging specifications), stainless steel (types 316, 304, 347) monel, alloy-faced carbon steel, and other special alloys. *Engineering Corp. of America.*

IT'S NEW CHECK IT

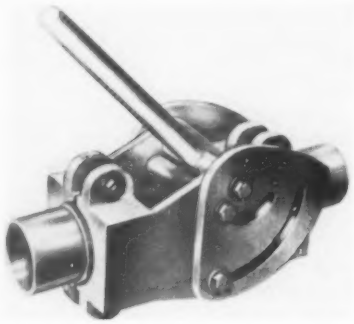
10 NEW KON-KAVE BOW FOR LATCH-ON CENTRALIZER. The centering ability of the latch-on centralizer has been greatly increased with the introduction of the Kon-Kave bow. The curved cross-section of each bow provides greatest strength and most resistance to deformation or breakage. Higher quality spring steel is hot formed by drop forging, to exact specifications. Normal heat treatment to develop the full strength of the alloy spring steel is supplemented by a later special heat treatment that removes stresses caused by welding the bows to the end collars. *B & W Inc.*



IT'S NEW CHECK IT

11 THERMO-PANEL PLATE COILS eliminate the need for expensive pipe coiling. They are simple to clean and are easily installed. Low in cost and light in weight, plate coils provide efficient heat transfer, and are available in standard sizes, as well as special sizes and shapes to meet individual requirements. They are obtainable in a wide range of materials, including stainless steel, monel, and other special alloys and finishes. They are available in parallel type for steam applications, or in series type for use with cooling or heating fluids. *Dean Products, Inc.*

12 PINCH TYPE VALVE. New type K, manually operated, quick-opening, pinch-type rubber valve is for handling slurries with grain sizes up to ⅛ in. and corrosive chemicals. It is available in sizes ¼ in. through 12 in., in pure gum rubber, neoprene, buna, butyl, and odorless, tasteless neoprene. Temperature limit is 180° F., and pressure limit is 100 psig. Valve has snap action at closing point. Bubbletight closure and self-supporting feature make for positive shutoff and ease of installation. Valve is for on-off service. Only rubber is in contact with fluid. Mechanical parts are aluminum with nylon bearings. *Robert K. Little.*



IT'S NEW CHECK IT

13 NEW TEFLON SEAL CAGE is for use with stuffing boxes on pumps mixers, reactors, and other types of processing equipment, These seal cages were developed to overcome the handicaps experienced with two-piece metal lantern rings. Chempro seal cages, machined in one piece, can be snapped over the shaft without dismantling pump or pulling the shaft. These Teflon seal cages will not score the shaft during operation, even at high speeds. In most cases, they may be counted on to last indefinitely. Their design and construction provide a seal cage that will not bend or collapse under extreme gland pressure. They are available in standard or special sizes to fit any pump, mixer or agitator. *Chemical & Power Products, Inc.*

IT'S NEW CHECK IT

14 MODEL DP-7 SENSITIVE PRESSURE TRANSDUCER is a sensitive instrument for the measurement of differential pressure in terms of electrical output. The range of working fluids encompasses all noncorrosive gases and liquids and the design allows a selection of working ranges from ±0.5 to ±15 psi. differential at line pressures up to 100 psi. The instrument will withstand the application of maximum line pressure in either direction. Applications of the model DP-7 include laboratory testing, radio telemetering, and process control where precise measurement of low differential pressure is required, both statically and dynamically. The instrument has been used to measure water depth variations as small as 0.002 in. at the base of a water column 4 ft. high, with an accuracy of 2 per cent of the variation range, at frequencies from 0-30 cycles per second. Operation is based on the variable reluctance principle. The output is derived from two inductances which vary 10 per cent in opposite directions with application of full pressure. *North American Instruments, Inc.*

TRADE LITERATURE

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15 PARACOIL HEAT EXCHANGERS. The diversified heat-exchanger products of this company are grouped for ready reference into chemical, industrial, power-plant, and marine classifications. Full technical description of the exchanger accompanies each of the more than 50 illustrations. A special section on industrial fuel oil heaters is also included. This 16-page Bulletin 1000 is recommended to all who must keep pace with the current trend in heat-exchanger design. *Davis Engineering Corp.*

16 STEAM-JACKETED VALVES. The bulletin concisely explains the distinctive design of operating mechanism and the special arrangement of steam jackets that have been proved to maintain satisfactory service when handling many different types of viscous materials such as heavy petroleum, coal tar, and chemical products, which congeal or harden at atmospheric temperatures and cause trouble with other valve designs. Illustrations include a large section through the valve and an exploded view which clearly shows its design, together with views of typical installations. *Everlasting Valve Co.*

17 DATA ON LIGHTWEIGHT PIPE. A new Bulletin 507 shows typical applications of its lightweight lockseam-spiralweld pipe and fittings. Included are standard specifications on pipe from 4 to 30 in. in diameter, together with data on fabricated fittings, flanges, and connections to meet all pipe-line requirements. *Naylor Pipe Co.*

18 DIFFERENTIAL - PRESSURE PNEUMATIC TRANSMITTER. Bulletin 2753 illustrates and describes a low-head-type differential-pressure pneumatic transmitter. Designed particularly for measuring liquid fuels, and the automatic control of the fuel-air ratio, the device produces a pneumatic output signal proportional to the differential pressure across a built-in orifice. Other features covered in the four-page booklet include construction details and cutaway view showing the no-sealing-fluid measuring assembly, economy of air consumption, operating characteristics, and simplicity of calibration. *Hagan Corp.*

19 PUSH BUTTONS, INDICATING LIGHTS, SELECTOR SWITCHES, ACCESSORIES. The full line of G.E. oiltight push buttons, indicating lights, selector switches, and accessories is described in a new 4-color, 16-page publication. Designated as GEA-5779B, the booklet explains how these devices operate and where they can be used. Included are cross-section drawings, full-color application photos, dimension and outline diagrams, and complete ordering information. *General Electric Co.*

20 DISTILLATION, ABSORPTION AND EXTRACTION covers custom-engineered columns, exchangers, reboilers, auxiliaries, and controls for use in distillation operations. The free literature illustrates and describes the various products available and engineering services covering such fields as fractionation, thermal design, and fabrication. Shown is a 20-plate stainless-steel fractionator with internal reboiler, a monel acid stripper with carbon-steel skirt, and a carbon-steel solvent separation column equipped with tunnel trays. *The Colonial Iron Works Co.*

21 GROUND RESISTANCE AND SOIL RESISTIVITY MEASUREMENT. Bulletin 1-1 presents latest technical data on measuring resistance of man-made grounds; theory, application, and methods of soil-resistivity measurement, and brief discussion of geophysical prospecting by electrical methods. It gives detailed description and operating characteristics of eight basic Vibroground ground-resistance measuring instruments. *Associated Research, Inc.*

22 CHEMICAL APPLICATIONS OF INDUSTRIAL GAS ANALYSIS emphasizes the importance of industrial gas analysis in inert purging operations, and safety applications where oxygen is the principal contaminant. This bulletin, AD-610, outlines a recommended list of equipment to provide an accurate and dependable analysis system for industrial gas process streams. *Arnold O. Beckman, Inc.*

23 LOW-TEMPERATURE PROCESSING OF GASES, LIQUIDS, SOLIDS. This 32-page book deals with the phenomena of low-temperature processing. Temperatures used range from 0° to —450° F. where gases become liquids, liquids become solids, and solids change their properties. The various applications of the process are illustrated in this book. *Air Products, Inc.*

24 SLUSH PUMPS, CONDUCTOR PUMPS, CEMENTING PUMPS. Cutaway drawings and complete engineering data are presented in a full line of oil-field slush and cementing pumps. The 2-color, 14-page folder is prepared in English by a German manufacturer. *Alfred Wirth & Co.*

25 CANISTER-TYPE GAS MASKS. Emphasis has been placed on clarifying the proper application of this type of protection. The bulletin covers such subjects as canister construction, canister life, methods of determining gas concentrations, heating and humidity, deficiency of oxygen, and presents data on recommended equipment for specific hazards in fire-fighting, industrial, and chemical fields. *Acme Protection Equipment Co.*

26 REGENERATIVE TURBINE PUMPS. A new 24-page brochure deals with the special designs of regenerative turbine pumps available for chemical service. The booklet contains an original approach to net positive suction head together with full data on the use of this concept in selecting turbine pumps for chemical service. It also contains a survey and evaluation of a variety of mechanical seals available in turbine chemical pumps. *Roy E. Roth Co.*

27 DYNAMOMETERS is 16-page, 2-color booklet, detailing a complete line of liquid-cooled, absorption, motoring, universal, and special-purpose dynamometers. Included in Bulletin DB-1 is descriptive matter pertaining to the construction of the equipment, accessories, and controls. Typical installations are detailed. Profusely illustrated, the booklet contains dozens of operating and product photographs, engineering drawings, graphs, and tables. *Dynamatic Division, Eaton Manufacturing Co.*

28 NEW HARDFACING ALLOYS CATALOG. Complete line of hardfacing and build-up rods and electrodes are fully described in a new 48-page, 2-color catalog. Typical applications are shown in over 70 photographs and full metallurgical and physical properties are included for the 4 automatic and 15 manual rods and electrodes. There is also a complete technical section with charts and photographs to aid in selecting the correct hardfacing rod for unusual or hard-to-solve wear problems. *American Manganese Steel Division, American Brake Shoe Co.*

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Among the Drilling Contractors

McRae Heads New Firm In Rocky Mountain Area

Roden & McRae Drilling Corp. is a newly organized drilling company operating in the Rocky Mountain region. It is headed by J. A. McRae, independent operator, who recently has moved from Midland, Tex., to Denver, where the new company has its principal office. Eight rotary rigs will be operated.

McRae also heads a newly formed, affiliated producing company, J. A. McRae, Ltd., which has acquired all production properties of the former firm of Roden, Darden & McRae. These properties extend over Texas, Oklahoma, Colorado, Wyoming, and Montana.

California Contractors Make Harmon Secretary

Appointment of Howard H. Harmon as permanent secretary of the California chapter of the American Association of Oilwell Drilling Contractors has been announced by the chapter's chairman, John Grant, vice president, Loffland Brothers Co.

Harmon is widely known in oil circles, having been associated for many years with various manufacturing and supplying companies serving the industry, not only in this country but also in South America, Mexico, and Canada. Lately, he has represented Pacific Valves, Inc., in New York City.

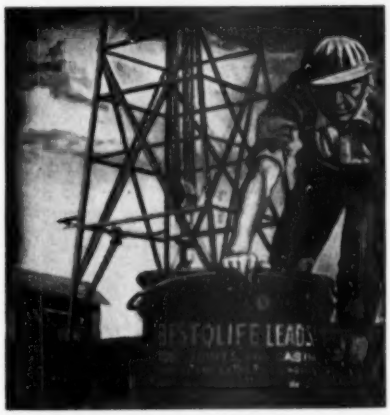
New Contracting Firm Will Drill in Colorado

Mike O'Donnell and William R. Edmondson, both formerly of Wichita Falls, Tex., have moved to Denver, where they have formed a partnership to engage in contract drilling in the northeastern Colorado portion of the Denver-Julesburg basin. They will operate as O'Donnell-Edmondson Drilling Co. and plan to have four rotary rigs running in the near future. Their initial rig was moved in the past week.

Douglas-Smith Drilling Co. is contractor on a 10,700-ft. test Bates & Cornell are starting in the Cankton area, St. Landry Parish, Louisiana Gulf Coast. Location is for 1 Savoie, in 25-8s-3e.

Drilling & Production Co., Los Angeles, has contracted with Reserve Oil & Gas Co. for two additional wells to be drilled in Tejon field, Kern County.

David Bell (center), driller for Brewster-Bartle Drilling Co., Houston, checks a Brown Duo-Pack packer about to be run in the hole preparatory to fracturing the prospective pay zone in a deep test the above contractor recently drilled for Sun Oil Co. in the Nelsonville area, west of Bellville, in Austin County, Texas Gulf Coast. Shown, left to right, are: R. O. McDougle, fireman; F. J. Frank, backup man; Bell; Fred Miller, service man, Brown Oil Tool Co., Houston; and Roy Ognoskie, lead-tong man. Jim Devault (not shown) is tool pusher on the rig. The well, 1 Macat Unit 2, was drilled to 10,512 ft., and now is being completed in sand at 9,736-55 ft. (Picture by courtesy of Mission Manufacturing Co.)



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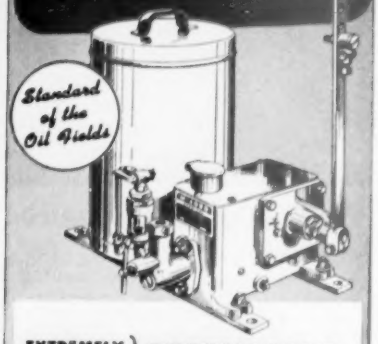

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California. Rigs are being moved in for both wells, 13-33, a Chanac sand test in 33-11-19, and 45-34, a Santa Margarita test in 34-11-19.

Enterprise Oil Co., Bakersfield, Calif., has contracts ahead for two new wells and a deepening job for Glenn C. Ferguson and I. W. Bosworth in McDonald Anticline field, in Kern County, California. Work will begin as soon as the contractor finishes another well it is drilling for the same operators near Salt Creek.

Tine Gaiser, Bakersfield, Calif., is scheduled to drill a projected 6,500-ft. wildcat test for J. K. Wadley and associates 5 miles northwest of Mendota, in Fresno County, California. Location is for 1 Anderson Clayton Co., in 20-13s-14e.

Hoover Drilling Co., Inc., Bakersfield, Calif., is drilling for Richfield Oil Corp. at a wildcat location, 2 Dodds-Thomas, 5 miles south of Temblor field, 10 miles west of McKittrick, in Kern County, California.

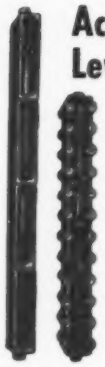
General Drilling Co. has a contract with Sunray Oil Corp. for a 5,500-ft. test, 1 Pollard, located about 1¾ miles southwest of East Payson pool, in Lincoln County, central Oklahoma. Location is in 14-12n-4e.

Clegg & Hunt, Houston, will drill another deep test for Houston Oil Co. in the Live Oak Plantation area, of Vermilion Parish, Louisiana Gulf Coast. The new operation, 2 Godchaux, about a mile east of the company's recently completed discovery well, 1 Godchaux, is projected to 14,000 ft. The discovery well was drilled to 13,435 ft. and completed in sand at 12,334-40 ft.

ACTIVE ROTARY RIGS*

Area	Week ended 2-22-54	Change week ended 2-15-54	Change week ended 2-23-53
Gulf Coast	517	0	−67
N. & W. Tex.-N. M.	780	− 7	−13
Ark.-N. La.-E. Tex.	181	− 1	+67
Oklahoma	373	−37	+56
Kansas-S. Neb.	150	+ 2	−18
Illinois-Eastern	133	+17	+30
Rocky Mountains	241	0	+56
Pacific Coast	143	− 4	−19
Total U. S.	2,518	−30	+92
Western Canada	143	+ 5	−13
Total	2,661	−25	+79

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States, and the Pacific Coast and Illinois-Eastern areas are shown on pages 147 and 148.



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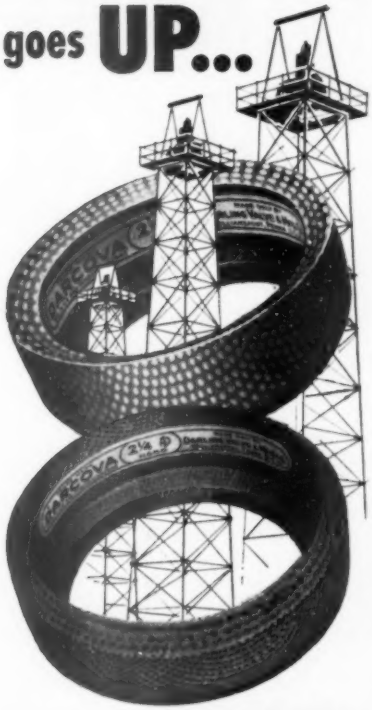

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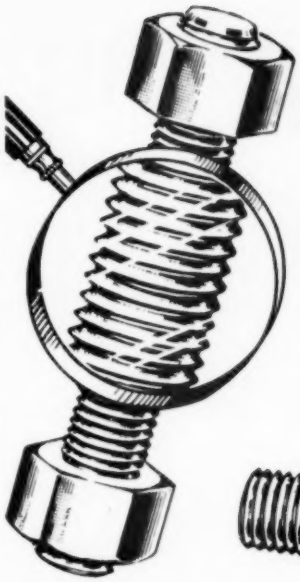

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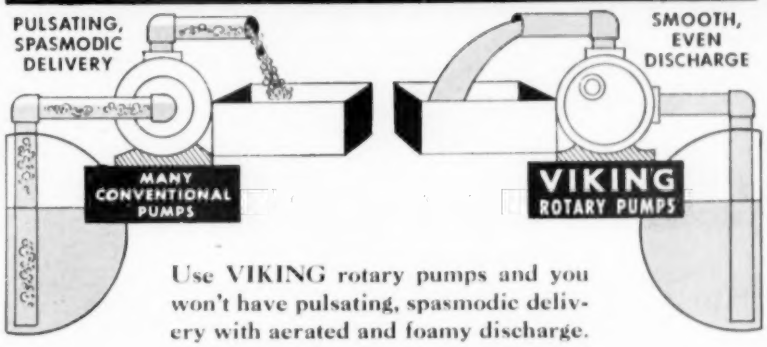

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PIPE LINE

New Line Proposed

Colorado-Western files for second gas system

DENVER.—Colorado-Western Pipe Line Co. of Dallas, Tex., which last month proposed a 454-mile, $33,000,000 natural-gas transmission and distribution system in Colorado, has proposed a new 328-mile, $21,600,000 line in the state.

The company filed a second application with the Colorado Public Utilities Commission for a certificate of public convenience and necessity to construct an intrastate system extending from a point in La Plata County in southwestern Colorado, over the Continental Divide, along the eastern slope to serve the cities of Pueblo, Colorado Springs, and Denver, and intermediate points along the line's route.

John A. McGuire, president of the new firm, said plans for the new line have been made possible by contracts recently negotiated with El Paso Natural Gas Co. along with other producers of natural gas from fields in La Plata and adjoining counties. The contract with El Paso is for 50,000 M.c.f. daily.

Original proposal . . . Colorado-Western's original petition was for construction of a line from the gas fields in La Plata, Montezuma, Dolores, San Miguel, and Montrose counties via Durango, Cortez, Montrose, Gunnison, and Salida. Lateral lines would serve Delta, Saguache, Monte Vista, Alamosa, Canon City, Florence, Portland, Buena Vista, Leadville, and Climax *(The Oil and Gas Journal, January 18, page 55).*

McGuire said Three States Natural Gas Co. is drilling tests in the western slope area to develop prospects on which "geological tests to date have been highly reassuring."

Survey specialists from the Denver University department of research are currently determining market potentials and requirement of natural gas in the areas and communities along the projected route of the originally proposed line.

The Colorado Public Utilities Commission has set for March 8 a hearing on the newly requested line and for September 7 a hearing for the originally planned line.

Western End of Products Line Started

Oklahoma Mississippi River Products, Inc., line crosses Crawley's Ridge near Forrest City, Ark., about 50 miles west of the eastern terminal of the new 475-mile products system, on which work has been begun from the western end. Work on the eastern end of the line, which runs from Sunray Oil Corp.'s refinery at Duncan, Okla., to West Memphis, Ark., has been completed from White River in Arkansas near Searcy to West Memphis and two crews are working east and west from the Arkansas River crossing near Dardanelle, Ark. Scheduled for completion during midsummer, the line will have an initial capacity of 35,000 bbl. of products daily.

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Permian's Carbon Dioxide Plant Winds Up Program

FORT STOCKTON, Tex. — The $3,000,000 Mitchell carbon dioxide removal plant of Permian Basin Pipeline Co. near here has been completed, marking the completion of the entire $42,000,000 construction program of the company which started in June 1952.

Mitchell plant in Pecos County has capacity to process 25,000 M.c.f. of natural gas daily for the first year of operations with provisions to expand capacity to 150,000 M.c.f. daily. It is one of the largest plants of its kind in the nation.

About 67 miles of 20-in. line connecting Mitchell plant with Permian's Plymouth compressor station in Reagan County has been completed and an additional 8 miles of gathering lines also have been completed.

The entire construction program in New Mexico and Texas includes four compressor stations, two dehydration plants, a sulfur removal plant, a gasoline plant, the carbon dioxide removal plant, and 234 miles of pipe line.

Completion of the construction program will make available an additional supply of 200,000 M.c.f. of gas daily to Northern Natural Gas Co., parent company of Permian, during the first year of operation and still another 100,000 M.c.f. daily during the second year.

Gulf Interstate's Line Work Ahead of Schedule

HOUSTON.—Delivery of the last of the 30-in. pipe required to complete Gulf Interstate Gas Co.'s new system is expected early in March.

In its annual report, Gulf Interstate said all but 28 miles of the approximately 1,150 miles of right-of-way have been acquired and substantially all other materials and supplies have been received.

The company said it expects completion of the line ahead of schedule and expects to begin delivery of gas to United Fuel Gas Co. not later than November 1 when United Fuel's facilities to receive the gas are expected to be completed.

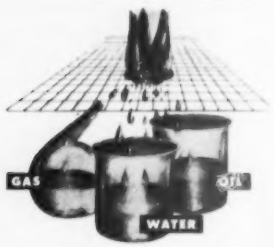
The main-line system runs 850 miles from Rayne, La., to Huntington, W. Va. When construction on it was shut down for the winter, about 630 miles of line had been completed, leaving 220 miles to be completed this year *(The Oil and Gas Journal, January 18, page 50)*.

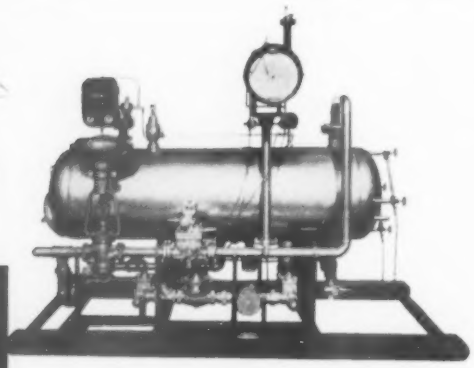
New Arkansas Louisiana Gas Line in Operation

SHREVEPORT, La.—Arkansas Louisiana Gas Co. has placed in operation about 45 miles of new pipe-line facilities in East Texas.

About 19 miles of new 14-in. pipe runs from the company's dehydrator plant near Longview, Tex., taking gas from Willow Springs field. In Hallsville field it joins about 25 miles of new 16-in. line taking gas from Hallsville field to the company's Waskom, Tex., gasoline plant.

Lone Star Constructors of Dallas, Tex., began the construction on No-





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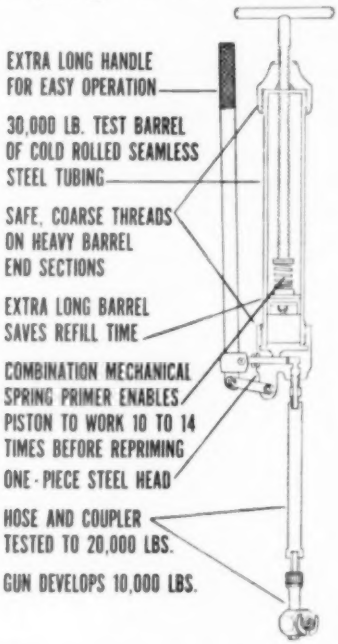
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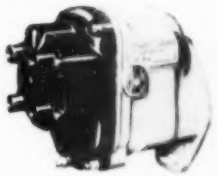

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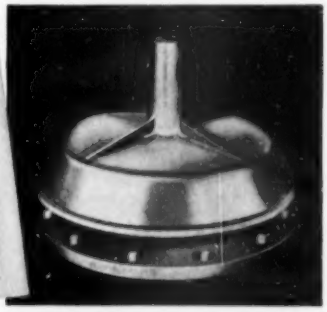

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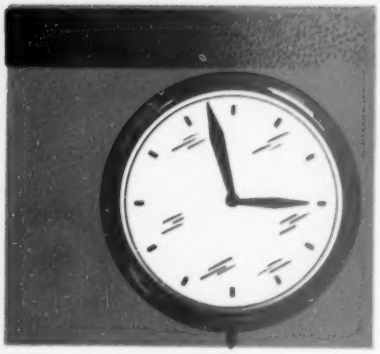

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vember 24 and completed it in mid-February. The new lines give Hallsville field its first outlet since its discovery over 2 years ago *(The Oil and Gas Journal, November 2, page 162).*

New Gas Financing Reaches Record Volume During 1953

NEW YORK.—A new record in financing by gas utilities and pipe-line companies was established during 1953, according to preliminary figures of the American Gas Association.

New financing by the gas utility and pipe-line industry totaled $1,049 million during 1953, compared with the previous record of $909 million in 1951 and $756 million in 1952.

Common stock issues of $160 million in 1953 were more than double the previous high set in 1950 and were up 150 per cent or about 2½ times over the $64 million received from sale of common stocks in 1952.

Preferred stock issues totaled $91 million, compared with $93 million in 1952.

New contractural debt issues totaled $798 million, of which $573 million represented sales of bonds, which compares with $343 million of bonds sold in 1952 and a previous record of $563 million in bonds sold in 1951.

Receipts from sales of debentures in 1953 totaled, $179 million against $71 million in 1952. The remaining $46 million of new financing came from other sources.

The proportion of equity financing represented by common stock was the highest attained during the post-war period, representing 15.3 per cent of the financing in 1953, compared with 8.5 per cent in 1952, 6 per cent in 1951, 8.9 per cent in 1950, and an annual average of 8.2 per cent for 1946-49.

A.S.C.E. Pipe-Line Meet Scheduled for April 8-10

MIDLAND, Tex. — The first conference of the American Society of Civil Engineers' new "Committee on Pipe Lines" will be held here April 8-10 in connection with the spring meeting of the Texas section of A.S.C.E.

Speakers will include Walter H. Davidson, general superintendent of Transcontinental Gas Pipe Line Co., Houston; Ford Bartlett, president of Lockwood, Kessler & Bartlett, New York; Earl K. Monteith, chief engineer of Studdert Engineering Co., Midland; Eldon V. Hunt, construction superintendent of Ebasco Services, Inc., New York; and E. R. Osburn, consulting engineer from Boulder, Colo.

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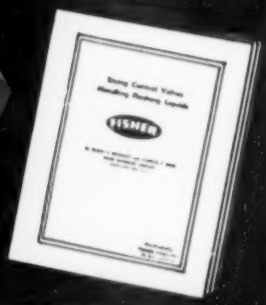

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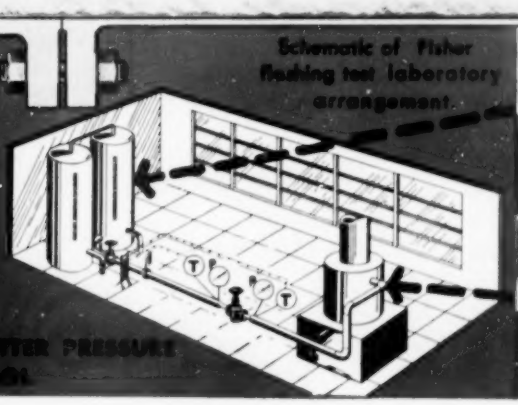

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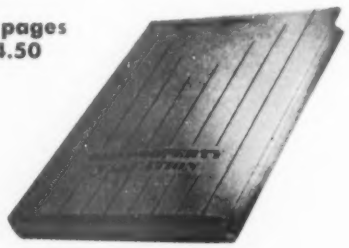

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The chemical plants division of Blaw-Knox Co., Tulsa, designed and installed the unit.

Hancock Oil Co. Announces Refinery Expansion Program

LONG BEACH, Calif. — Hancock Oil Co. plans a $5,000,000 expansion program at its 12,500-bbl. refinery here, including a thermofor catalytic cracking unit and a catalytic polymerization unit.

The thermofor catalytic cracker, licensed by Socony-Vacuum Oil Co., Inc., would have a capacity of 6,000 bbl. per stream day, and the Universal Oil Products Co. catalytic polymerization unit would have a capacity of 500 bbl. per stream day.

Hancock has not yet named the contractor for the construction of the units.

1953 Oil Refining Dividends Reported at Record Level

WASHINGTON.—Oil refining corporations paid $44,600,000 more in dividends in 1953 than in the previous year, according to the Department of Commerce.

The department listed the publicly announced 1953 dividends at $1,039,600,000, compared to $995,000,000 in 1952. December dividend payments alone amounted to $303,300,000, compared to $266,200,000 in the comparable 1952 month, reflecting higher extra and special dividends.

The refinery dividend increase of about 4.5 per cent in 1953 was substantially above the increase of 2.5 per cent recorded by all corporations and the 1.5 per cent reported for manufacturing corporations generally.

58 Per Cent of Los Angeles County Tanks Smog-Proofed

LOS ANGELES, Calif. — Air Pollution Control Director Gordon P. Larson told the Los Angeles County Board

NELSON REFINERY CONSTRUCTION INDEX

Appears in the first issue each month.
Explanation—"News Items That Appear in Quarterly Cost Indexes," July 7, 1952, pages 105 and 106.
Compiled by W. L. Nelson—Petroleum Refinery Consultant—Tulsa.
Indexes of Individual Equipment Items—January, April, July and October.

INDEX (1946 = 100)

	1948	1949	1950	1951	1952	Nov. 1953
Pumps, compressors, etc.	127.0	135.9	138.2	155.9	155.6	168.4
Electrical machinery	127.6	130.9	134.9	154.3	152.4	160.3
Internal combustion engines	116.9	124.8	126.0	146.1	146.5	149.7
Instruments	120.0	†123.1	127.8	142.3	146.2	155.0
Heat exchangers	130.0	133.0	140.0	152.0	165.8	179.5
Miscellaneous equipment average	*122.1	*121.6	*126.2	*145.1	153.3	162.6
Materials component	139.3	143.6	149.5	164.0	164.3	175.8
Labor component	128.0	137.1	144.0	152.5	163.1	179.0
Refinery Construction Index	132.5	139.7	146.2	157.2	163.6	177.7

*Used in computing the Nelson Index until April 1952. These are slightly different than the average of the miscellaneous equipment items shown above. †Corrected value.

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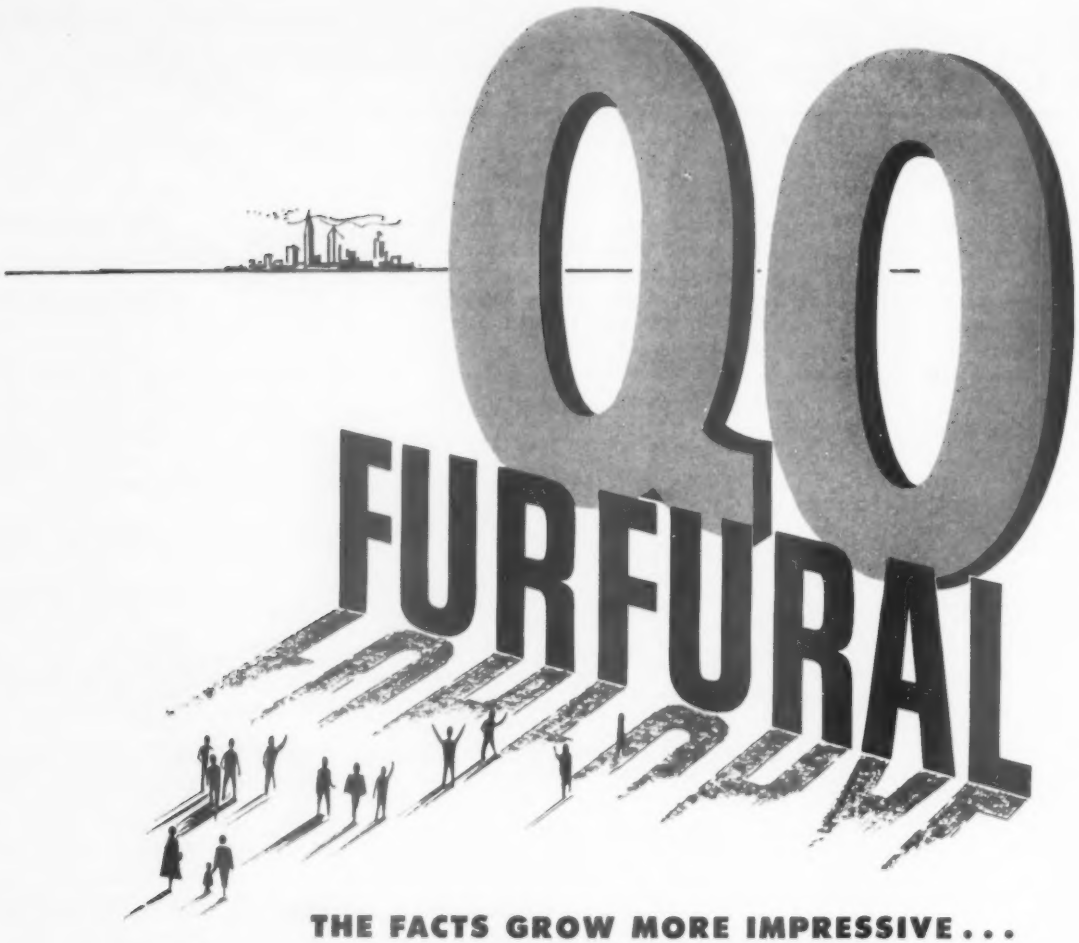

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of Supervisors that refineries and terminals in the county have equipped 58 per cent of their gasoline tankage with vapor recovery systems or floating roofs.

He said that of 80 tanks requiring control under county smog regulations, 27 still lack some type of vapor-recovery device. Companies owning the tanks, he added, are asking for more time to complete installations.

Socal Introduces New Lube Oil for High-Power Engines

LOS ANGELES, Calif. — Standard Oil Co. of California has introduced a new lube oil designed to answer the problems brought on by higher powered automobile engines.

The new oil, RPM 10-30 Special, is a bright ruby red lube and is said to have properties which allow it to flow like a 10-grade oil at cold temperatures and like a 30-grade oil at hot temperatures.

In tests, the new oil has shown it increases gasoline mileage by 15 per cent, cuts noise and sticking of hydraulic valves, gives more power, and permits easier starting in all climates, and cuts down oil consumption, the company said.

Petrochemicals

Solvay Plans Movement Of Its Products by Barge

NEW YORK.—Solvay Process Division of Allied Chemical & Dye Corp. has announced plans for barge movement of products from its new Moundsville, W. Va., plant to customers on or near inland waterways of the Ohio River and its tributaries.

Pihl & Miller of Pittsburgh, Pa., have been awarded contract for construction of a barge-loading dock at the Moundsville plant with completion scheduled within 60 days.

The new dock also will be available to Solvay's associate, National Aniline Division, for shipment of nitrobenzene and aniline from its Moundsville plant.

Pan American Refining Plans Petrochemical Plant

TEXAS CITY, Tex.—A new petrochemical plant to produce methyl mercaptan will be built at the chemicals plant near its 135,000-bbl. refinery here by Pan American Refining Corp.

The unit will have a capacity of about 5,000,000 lb. per year and will be the first multi-million pound plant to produce high-purity methyl mercaptan synthetically.

The process for the manufacture of methyl mercaptan from hydrogen sulfide and methanol, to be used in the new plant, was developed through extensive research and pilot-plant operations by the research and development department of the company here.

Rust Engineering Co. of Pittsburgh, Pa., has the contract for the construction of the plant which is expected to be in operation during the last quarter of 1954 with full capacity production expected by January 1, 1955.

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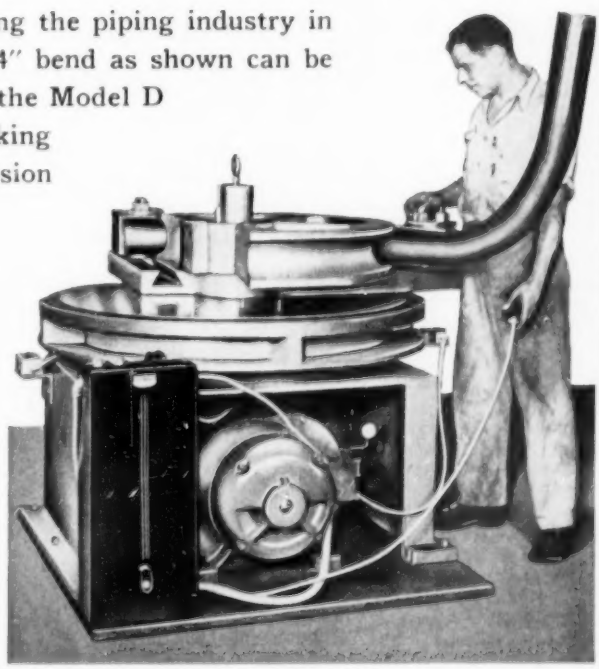

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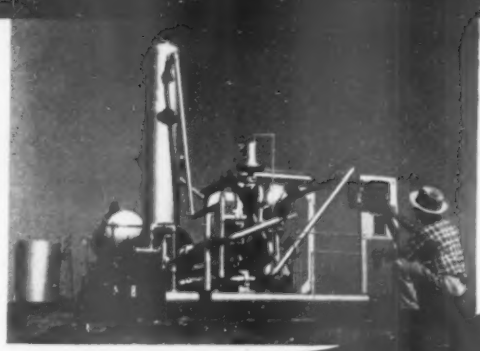

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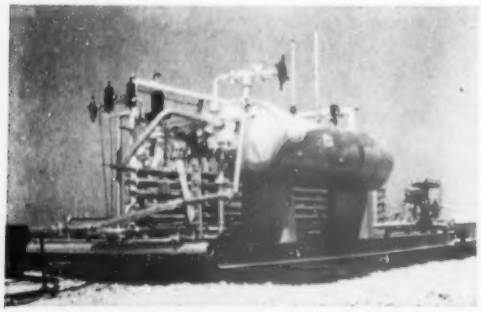

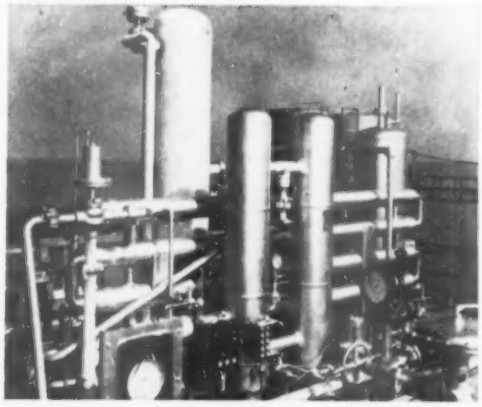

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NATURAL GAS

Penn-Jersey's Hearing Scheduled for March 8

WASHINGTON. — An application by Texas Eastern Penn-Jersey Transmission Corp. for construction of a 3,300-hp. compressor station in Pennsylvania and a 265-mile, 24-in. transmission line in Pennsylvania and New Jersey have been scheduled for hearing on March 8 by the Federal Power Commission.

Also to be heard at the same time are applications by Texas Eastern Transmission Corp., parent company of Texas Eastern Penn-Jersey, and Transcontinental Gas Pipe Line Corp. for proposed increased peak-day and daily deliveries of natural gas to certain customers.

Texas Eastern also plans to perform a storage service for Transcontinental through the use of Penn-Jersey's new line which it would lease. The new line would cost $30,766,300 and Transcontinental's application includes facilities which would cost $131,628 *(The Oil and Gas Journal, January 4, page 121).*

A.G.A. Reports December Natural-Gas Sales Up

NEW YORK.—The American Gas Association reported natural-gas sales during December 1953 were 0.5 per cent over sales during the same month a year ago, while there were 3.7 per cent fewer degree days during December 1953.

Sales of 5,299,683,000 therms of natural gas in December 1953 were reported, compared with sales of 5,273,000 therms in December 1952. A therm is 100,000 B.t.u., roughly equivalent to the energy produced by 100 cu. ft. of natural gas.

December Gas Production In Texas Shows Slight Rise

AUSTIN, Tex.—The Texas Railroad Commission reported gas production for the state during December 1953 was up .26 per cent over production during December 1952, and the amount available for market was up .92 per cent over the same month a year ago.

During December 1953, total gas production reported for Texas was 474,851,572 M.c.f., of which 412,251,713 M.c.f. was available for marketing. Of the gas produced, 358,239,080 M.c.f. was from 10,257 gas wells and 116,611,794 M.c.f. was from 93,279 oil wells.

Gas Increase Forecast

NEW YORK.—Production of natural gas may reach 12 to 14 trillion cubic feet a year by 1960, according to a forecast by Lyon F. Terry, vice president of Chase National Bank. This compares with a 1952 production of 8.64 trillion and a 1949 output of 6.25 trillion cubic feet.

The estimate was made before the recent annual meeting of the National Federation of Financial Analysts Societies. In reporting Terry's speech originally, the Journal erroneously said the output of 12 or 14 trillion cubic feet might be reached in 1956, instead of 1960.

Gas Association Accident Prevention Conference Set

SAN FRANCISCO.—The annual accident prevention conference of the Pacific Coast Gas Association will be held here March 10-11 in the Fairmount Hotel, overlapping the group's distribution conference on March 9-10.

A feature of the accident prevention conference will be a panel discussion on March 11 in which four specialists will take part. Making up the panel will be R. W. White of Pacific Gas & Electric Co., A. C. Blackman of California Division of Industrial Safety, R. E. Donovan of Standard Oil Co. of California, and E. E. Taylor of Southern California Gas Co.

In the afternoon session of March 10, L. F. Dishman of Pacific Pipeline Construction Co. will discuss, "Safety Procedures as Practiced by Pipe-Line Contractors."

Natural Gasoline

Sterling Oil's Gasoline Plant to Go On Stream

TULSA. — Completion is scheduled this month for the new $500,000 gasoline plant of Sterling Oil of Oklahoma, Inc., near Garber in Garfield County, Oklahoma, adjacent to East Spring Valley field.

The plant initially will process about 10,000 M.c.f. of gas daily and will have a maximum capacity of about 14,000 M.c.f. daily.

Liquid products recovery will be about 400 bbl. daily. Sterling Oil has 14 wells in the field, but gas from other operators in the field and from another nearby field may be processed in the plant.

Dehydrating Plant Capacity Increased

Oklahoma Natural Gas Co. has completed remodeling and doubling the capacity of its dehydration plant at its Depew underground storage station near Depew in Creek County, Oklahoma. Black, Sivalls & Bryson designed and built the plant, which now has a capacity of 800,000 M.c.f. of gas daily at 800 psi. pressure. Currently the plant is processing about 600,000 M.c.f. of gas daily at 635 psi. pressure.

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EXPLORATION

Oil on the Chadron Arch?

by John C. McCaslin

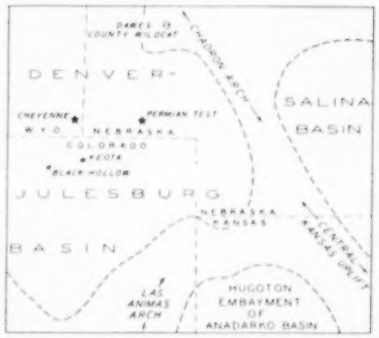
TESTING of sands tentatively identified as Permian is due at a remote wildcat in Dawes County on the Chadron arch of northwestern Nebraska. Cree Drilling Co. has run casing at its 1 State, C SE SE 16-29n-49w, about 23 miles south of the town of Chadron. No shows were reported in the Cretaceous sands, which are the main pays in the Denver-Julesburg basin to the southwest. Testing will reportedly take in three sand sections. The decision to run casing for complete tests was made after log interpretation.

Little drilling has been done in this section of Nebraska. There have been some shallow wildcats drilled to the north of the 1 State. Gulf Oil Corp. recently drilled a 3,956-ft. dry hole about 12 miles to the northwest. The Chadron arch has commanded considerable interest in the past few years, however, and both majors and independents hold sizable lease spreads throughout northwestern Nebraska.

The Chadron arch . . . This is a broad, southeastward-plunging uparch of pre-Cambrian rocks running northwestward across Central Nebraska, and is the northerly extension of the Central Kansas uplift, a prolific producing area. The Cretaceous-Dakota rocks over the arch are about 1,000 ft. higher than in the Salina basin, its northeastern neighbor and, due to a westward tilting of the area in Cretaceous time, are several thousand feet higher than in the depths of the Denver-Julesburg basin.

Pennsylvanian rocks lie on top of the pre-Cambrian rocks along the Chadron arch just north of the Kansas line where the Arbuckle is wedged out. Where this situation occurs on the Central Kansas uplift some fields have produced oil from pre-Cambrian rocks, apparently from deeply weathered surfaces or from fractures. It is thought that most Central Kansas uplift oil can be credited to the Pennsylvanian rocks, regardless of where it is now found. It is very possible that oil will be found under the same conditions on the Chadron arch in Nebraska.

The Chadron arch is the geologic northeast boundary to the highly productive Denver-Julesburg basin of



Regional setting of the Chadron arch in relation to the Central Kansas uplift, and the Salina and Denver-Julesburg basins. Stars indicate current and recent Permian tests in the area.

northeastern Colorado and western Nebraska. Nearly all of this basin's production is from the Cretaceous-Dakota sands. The younger Cretaceous-Greenhorn was found productive in the one field last year to become a second prospective pay.

Permian activity . . . It is interesting to note that the showings reported in the Dawes County test are from the Permian. Permian production was opened in the Denver-Julesburg basin only last year at Keota and Black Hollow fields in Weld County, Colorado.

The two Permian-Lyons sandstone oil discoveries last year in the basin accelerated interest in the future of deep drilling in the area. In addition to five tests now under way in Weld County, Permian wildcats are slated for western Nebraska areas, also. Ohio Oil Co. will test Permian sands at a wildcat in Cheyenne County in the general Southwest Sidney area. Commercial Cretaceous production has already been indicated at this wildcat.

The importance of the decision to continue on to the deeper horizons lies in the fact that this part of Nebraska has had very little pre-Cretaceous drilling. Tests were drilled in Huntsman and North Sunol fields to the north unsuccessfully after the Black Hollow discovery in Colorado last year. Permian deep tests were also drilled recently in the Enders and Southwest Potter fields of Kimball County. Good Lyons sandstone development was reported at Enders, but it was found to be water bearing. The Huntsman and North Sunol wildcats reported no Lyons sand at all. A Permian test also was drilled in extreme southeastern Wyoming's portion of the Denver-Julesburg basin without success.

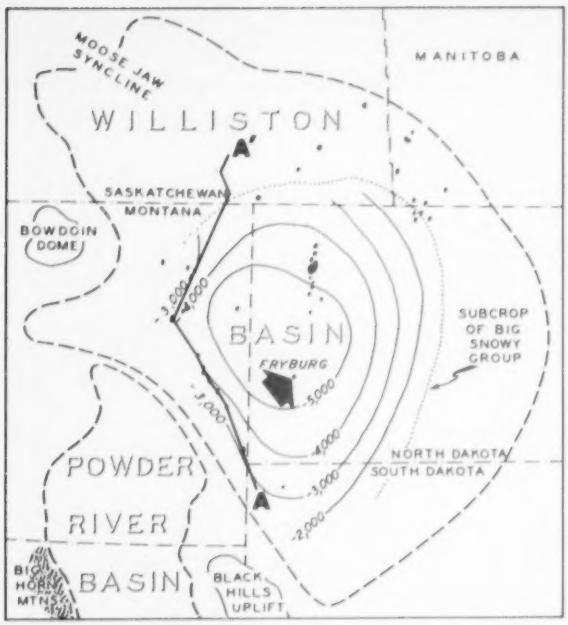
Lyons sand . . . The Lyons sandstone is apparently very extensive in the Denver-Julesburg basin. It outcrops along the Front Range forming hogbacks. It is characterized by conspicuous crossbedding at its type locality near Boulder. The Lyons is believed to have its maximum subsurface development in the Sierra Grande-Apishapa arch in southeastern Colorado. Here it is normally clean and is coarse grained. Some wells in the area found the sand to be more than 300 ft. thick. The Lyons sandstone is apparently a beach sand which developed around the Sierra Grande-Apishapa arch and north along the Front Range. It becomes finer grained with increasingly more shale in its eastward equivalents in Kansas and Nebraska.

John Maher (USGS) has established the increase in the percentage of clastics in Permian and Pennsylvanian rocks westward from Kansas toward the Front Range. A wealth of porosity in pre-Cretaceous rocks in the Denver-Julesburg basin due to this facies change can be expected. It is thought that a northeast-southwest-trending area of no pre-Pennsylvanian rocks may cut across the Denver-Julesburg basin. There are no Mississippian rocks along the Central Kansas uplift either. The Pennsylvanian, which lies directly on the pre-Cambrian, produces a considerable amount of oil in Kansas.

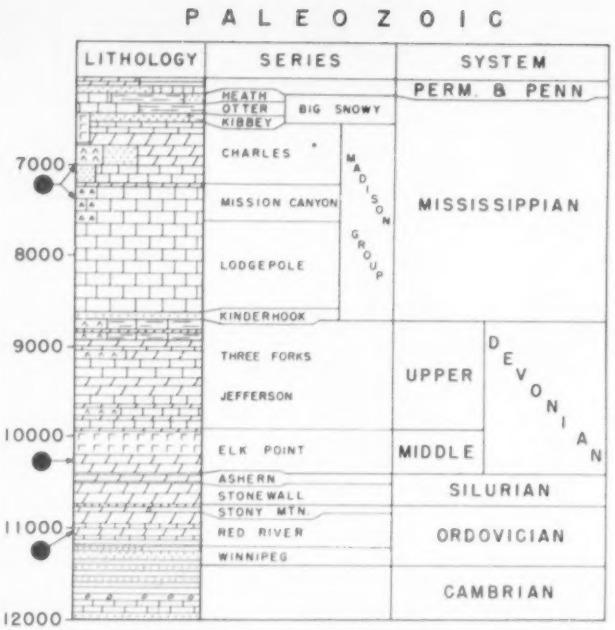
The area in and around Salina basin and Chadron arch is still largely untested. The basin and the arch are both wide open for future drilling and exploratory seismic work before their future as oil-producing areas can be evaluated.

Reference

P. C. Ingalls, "Denver Basin's Opportunities Expand," May 11, 1953, p. 167, The Oil and Gas Journal, and "Nebraska's Salina Basin," February 23, 1953, p. 233.



SUBSURFACE STRUCTURE contour map of the top of the Big Snowy group. Line of Section A-A' appears opposite. (Fig. 1).



LOWER PALEOZOIC columnar section of the Williston basin portrays position of members of Big Snowy group (after T. R. Barnes). (Fig. 2).

WILLISTON BASIN POTENTIAL

Big Snowy Group Promises New Reserves

by Joseph A. Kornfeld

RECENT drill-stem tests in the Heath sandstone in Fryburg field of Billings County, North Dakota, point to this member of the Big Snowy group of Mississippian age as a potential source of new reserves in the Williston basin. Fryburg field is presently producing from the Mission Canyon limestones which lie at greater depths in the Mississippian section. (See Fig. 1.)

Most promising portion of the Williston basin for the Big Snowy group lies on the south limb comprising southwestern North Dakota. Members of the Big Snowy group are truncated progressively southward and are overlapped by lower Pennsylvanian rocks principally the Amsden formation. (See Fig. 3.) Levorsen[1] says that this area may produce from stratigraphic traps in any of the members of the Big Snowy group.

Fryburg Field

Last week, the best drill-stem-test recovery to date from the Heath sandstone in development in Fryburg field was recorded at Amerada Petroleum Corp.'s 1 Dan Cheadle, C SE NW 9-139n-100w, at the diagonal southwest offset to the discovery well. From the Heath, 1 Cheadle recovered 2,412 ft. of free oil following a 4¼-hour drill-stem test from 8,245-67 ft. in Heath sandstone topped at 8,267 ft.; on last report at week end, it was drilling below 9,237 ft.

First well in this field to drill-stem test the Heath was Amerada's 1 W. E. Logan, C SE SW 4-139n-100w, ½ mile northwest of the discovery; the Logan recovered 1,220 ft. of free sweet oil testing 49.2°-gravity following a 4-hour drill-stem test from 8,204-44 ft.

Second well in Fryburg field to show oil on drill-stem test in the Heath sandstone was Amerada 1 F. C. Franchuk, C NW SW 10-139n-100w, which recovered 114 ft. of free, black oil after a 4-hour drill-stem test from 8,194-8,257 ft. Gravity was 38.7° A.P.I.

Daglum Buttes prospect . . . Last August, on the Daglum Buttes prospect in Stark County, 18 miles southeast of Fryburg field, Plymouth Oil Co. recovered a good gas showing in the Heath member at 1 Frank A. Fischer, C SE NE 11-137n-98w. Heath member was encountered at 7,850 ft. (—5,053 ft.) by samples, and core from 7,924-30 ft. recovered 3 ft. of hard limy shale and anhydrite, 2 ft. of black to gray shale, and 1 ft. of dark, dense, fractured limestone. Drill-stem test conducted from 7,884-7,930 ft. to evaluate this coring recovered 70 ft. of mud and 40 ft. of heavily gas-cut mud. However, this well was completed as a dry hole.

Stratigraphy

Generalized columnar section of the Paleozoic system in the Williston basin by T. R. Barnes in Fig. 2 shows the position of the Big Snowy group of Mississippian age comprised of Kibbey, Otter, and Heath members in ascending order. A thickness of 600 ft. is reached in the Fryburg area in Billings County. (See arrow.)

Kibbey member, lowestmost of the Big Snowy group, is comprised of red quartz sandstone, shales, and anhydrite, according to Towse.[2] In southwestern North Dakota, the Kibbey attains a maximum thickness of 332 ft. in Dunn County in Carter-Sinclair-Socony 1 Lockwood, C SE SW 5-147n-93w.

Otter member, middle member of the group, is comprised of varicolored

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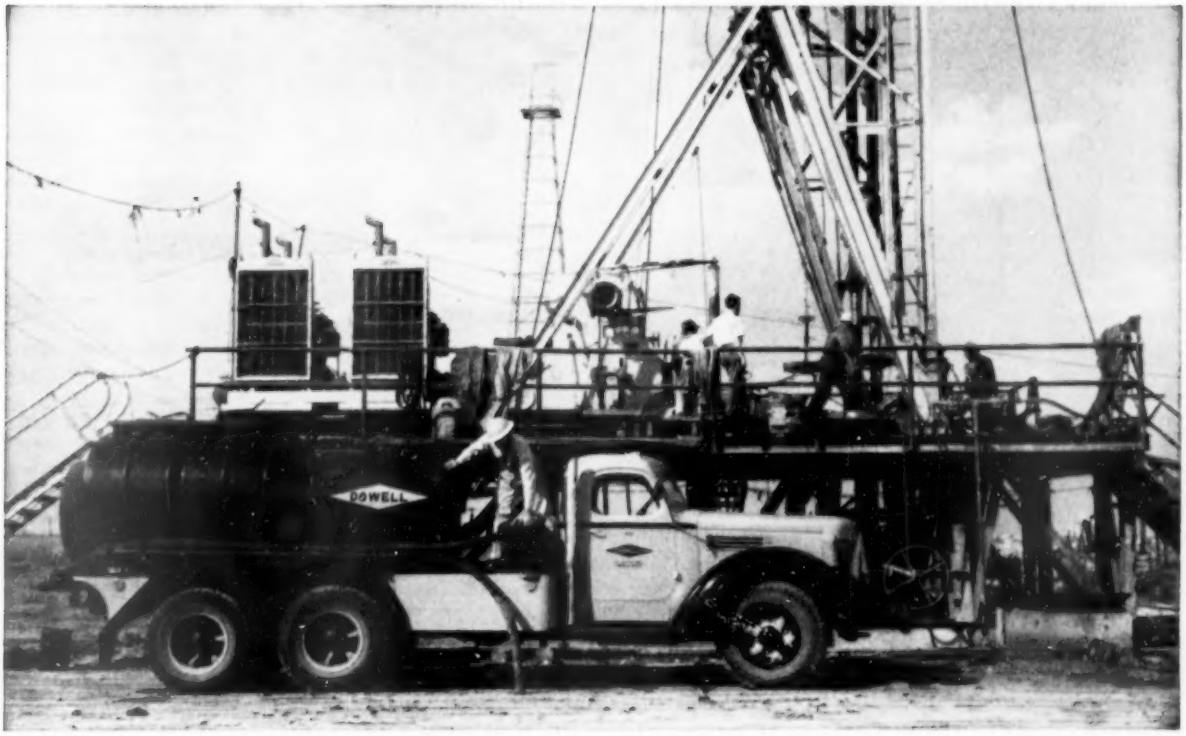

Production suffers when the critical area of a well is blocked. Eliminating the blocking materials so that the well can flow freely often presents a major problem to oil producers.

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This is but one example. There are many others, where Dowell Mud Acid has spelled the difference between profit and loss. Results show that cement squeeze jobs are more often successful if Mud Acid is used ahead of the cement. And many operators use it to help free stuck drill pipe.

If you'd like to know more about Dowell Mud Acid, and if you're interested in learning more about Dowell's many other oil field products and services, be sure to contact your nearest Dowell office soon. Or, write directly to Tulsa, Dept C-11.

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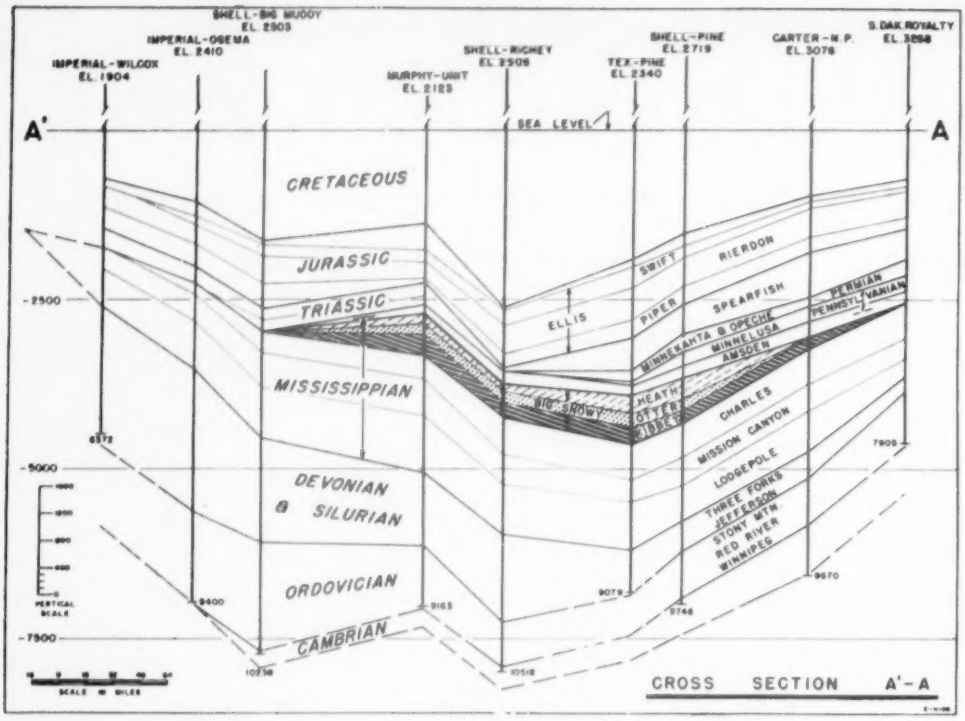


NORTH-SOUTH CROSS-SECTION of rocks taken along the western limb of the Williston basin following the Cedar Creek anticline, shows the Amsden (Pennsylvanian) overlap of members of Big Snowy group (after T. R. Barnes). (Fig. 3).

shales and dolomite. Maximum drilled thickness in North Dakota is 140 ft. in Blackwood & Nichols 1 M. E. Gilman, C NE SE 15-140n-105w.

Heath member, upper member of the group, is well developed throughout the center of the Williston basin. Thickness is 200 ft. in Plymouth 1 Fischer in Stark County. Heath thins southward to feather edge in Bowman County, North Dakota. Lithology is dark, carbonaceous shale with some interbedded dolomite. Locally, sandstone lentils are developed as in the Fryburg area where these have indicated sweet oil on drill-stem test. However, no commercial wells have been developed to date from any members of the Big Snowy group.

Nieschmidt[3] states that "the Heath shale is conformably overlain by the lower member of the Amsden formation and is transitional upward into it. The Heath is transitional downward into the underlying Otter."

Overlapping the Big Snowy group throughout most of the Williston basin is the Pennsylvanian Amsden formation comprised of pink dolomites, shale with some sandstone.

Structure

Regional structure of Big Snowy group is portrayed in Fig. 1. Big Snowy group is represented throughout all of the western half of North Dakota, the northwest corner of South Dakota, and extends throughout eastern Montana into the central part of that state.

Subcrop at easternmost boundary of the group in North Dakota generally coincides with the 1,500-ft. contour as mapped on top of the Big Snowy group. Members of the group thin progressively to feather edge at the northern, eastern, and southern boundaries of the Williston basin. Northern limits are found in the southern boundary of Saskatchewan. Progressive truncation takes place in the southern limb of the Williston basin where the group is overlapped by the Amsden as the Black Hills uplift is approached. Rapid thinning and truncation also are apparent in southeastern Montana towards the southern portion of the prominent Cedar Creek anticline.

In West-Central North Dakota, where all members of the Big Snowy group are represented, the top of the uppermost

DISTRIBUTION OF BIG SNOWY GROUP IN SOME DEEP WELLS IN WILLISTON BASIN—NORTH DAKOTA WELLS

County, operator, lease, and description—	Surface elev. k.b.	Heath, ft. subsea	Otter, ft. subsea	Kibbey, ft. subsea	Top of Charles Salt, ft. subsea	Total thickness, Big Snowy group*	Status
Bowman:							
Hunt Oil-Zach Brooks 1 State, C NW NW 16-129n-104w	3,212	(†)	(†)	—3,698	—3,808	110	fshg.
Billings (FRYBURG FIELD):							
Amerada 1 Herman May, C NW NE 9-139n-100w	2,761			—5,676	—5,939		oil well
Amerada 1 Logan, C SE SW 4-139n-100w	2,785	—5,365	—5,575	—5,681	—5,954	616	oil well
Amerada 1 Franchuk, C NW SW 10-139n-100w	2,758	—5,438	—5,579	—5,678	—5,937	499	oil well
Amerada 1 Cheadle, C SE NW 9-139n-100w	2,829	—5,338					drlg.
Dunn:							
Socony-Vacuum F-42-6P Dvorak, C SE NE 6-141n-94w	2,295	—5,297	—5,490	—5,635	—5,803	506	drlg.
Carter-Sinclair-Socony 1 Lockwood, C SE SW 5-147n-93w	2,145	—5,529	—5,647	—5,773	—6,105	576	drlg.
Golden Valley:							
Blackwood & Nichols 1 Gilman, C NE SE 15-140n-105w	2,867	—5,230	—5,365	—5,505	—5,817	587	drlg.
Gulf Oil-N.P.R.R. 1 Govt.-Dorough, C NE SW 24-143n-103w	2,515	—5,483	—5,605	—5,740	—6,059	576	drlg.
Hettinger:							
Socony-Vacuum F-14-24P Jacobs, C SW SW 24-134n-96w	2,614	—4,101			—4,596	495	drlg.
Slope:							
Deep Rock-Stanolind 1 Brusich, SE SE SE 8-135n-98w	2,797	—4,213		—4,963	—5,228	1,015	dry
Stark:							
Plymouth 1 Fischer, C SW NE 11-137n-98w	2,797	—5,053	—5,253	—5,373	—5,646	593	dry

*To top of Charles salt. †Absent.

member—the Heath shale—is found at subsea depths greater than 5,000 ft.

Oil and Gas Possibilities

Stratigraphic traps may exist in various members of the Big Snowy group in the south limb of the Williston basin including: (1) sandstone beds of the Heath shale where they are unconformably overlain by impervious beds of either the Heath or the Amsden formation, and (b) truncated beds of the Kibbey limestone where they are unconformably overlain by the Amsden formation. Under all of these conditions, local structure is essential for oil accumulation.

References

1. Levorsen, A. I., personal communication.
2. Towse, Donald, "Subsurface Geology of South-Central North Dakota," Bull. 27, North Dakota Geological Survey, 1952.
3. Nieschmidt, Constance L., "Subsurface Stratigraphy of the Heath Shale and Amsden Formation in Central Montana," Oil and Gas Investigations, USGS Chart OC 50, 1953.

LEGAL

Sealed bids for oil and gas mining leases on 12,821.75 acres of trust lands on the Crow Indian Reservation Big Horn County, State of Montana, will be received at the Office of the Superintendent of Crow Indian Agency, Crow Agency, Montana, up to 2:00 o'Clock P.M. (MST) Friday, March 19, 1954. For further information, call or write L. C. Lippert, Superintendent, Crow Indian Agency, Crow Agency, Montana.

LOUISIANA

SOUTH LOUISIANA

New Distillate Producer Extends Shuteston Area

Gas-condensite production in the Shuteston area, St. Landry Parish, is being extended approximately a mile to the northwest with completion by Pan American Production Co. of its 1 Lavergne. Testing the Frio-Tweedel zone through perforations at 10,897-910 ft., the well, on a 19-hour gage through ¼-in. choke, flowed at the rate of 4,500,000 cu. ft. of gas per day with 30 bbl. of 46°-gravity condensate per million cubic feet. Flowing pressure was 3,100 psi. Hole had been drilled to 11,242 ft.

Other production in the Shuteston area is largely from the slightly shallower Nodosaria sand.

Second Well Started in New Vermilion Oil Field

Houston Oil Co. of Texas is following its recent oil discovery in the Live Oak Plantation area of Vermilion Parish with the immediate starting of a confirmation attempt located approximately a mile east. The confirmation test, 2 Godchaux, in 19-14s-4e, is projected to 14,000 ft., which will carry it below the 12,300-ft. sand found productive in the discovery well, 1 Godchaux.

In the meantime, potential gage was taken of the discovery well, crediting it with a flow of 374 bbl. of 34.1°-gravity oil and 334,000 cu. ft. of gas in 24 hours through 10/64-in. choke. Interval produced is at 12,334-40 ft. The well also has a deeper potentially productive sand at 12,900 ft., from which a flow of 275 bbl. of condensate with 5,500,000 cu. ft. of gas per day was recorded. Total depth is 13,435 ft.

The area is approximately 15 miles south of Abbeville, and 6 miles southwest of South Erath field, nearest other production.

Lake Washington Well Tests Deep Production

Deep sands around the flanks of Lake Washington dome, in Plaquemines Parish, have been found productive in another well drilled by John W. Mecom.

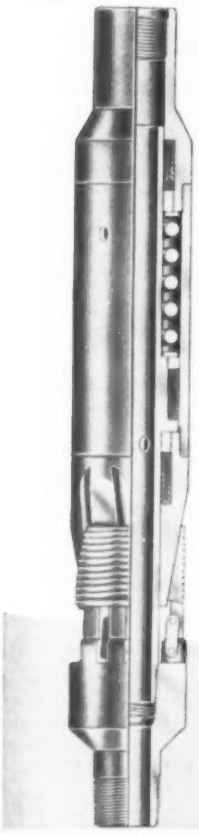
The well, 15 Cockrell, in 25-19s-26e, first tested a sand at 12,592-608 ft., getting a flow of 428 bbl. of 34.4°-gravity oil per day through ¾-in. chokes with 2,200-psi. pressure and gas-oil ratio of 9,990 cu. ft. per barrel. Later tests of a deeper zone at 13,423-50 ft. got a flow of 211 bbl. of 48°-gravity oil through ¾-in. chokes with 3,600-psi. pressure and gas-oil ratio of 8,448 cu. ft. of gas per barrel.

Both zones have been squeezed, and tests of other indicated deep pay zones will be made before completing the well. Location is on the northwest side of the dome.

In the meantime, this operator has made location for a deep test approximately 3 miles off the northwest flank of the dome on State Lease 2279, in 19-19s-26e. Hole is projected to 16,000 ft.

Iowa Adds Deep Producer

Shell Oil Co. has completed another good producer in the new deep-sand development



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play under way on the north flank of the old Iowa field, on the Calcasieu-Jefferson Davis parish line. The well, the second on the company's Corbello lease, is the most northerly producer completed to date. Potential gage was 551 bbl. of 34.3°-gravity oil per day through ¼-in. choke. Pay interval is 9,512-20 ft. Location has been made by Magnolia Petroleum Co. for a southeast offset at 1 LeFranc. Both wells are in 6-9s-6e.

OKLAHOMA

Drilling in Lindsay Pools Is Picking Up Speed

Two McClain County oil pools show an increase in drilling activity. Gulf Oil Corp. 1 Jacobs, C SW NW 8-5n-4w, 1 mile north of the discovery of Northwest and North Lindsay pools, has pulled core from 13,708-100 ft. Several intervals showed porosity and some odor and stain. Tulip Creek was topped at 13,091 ft.

East of the pool Tide Water Associated Oil Co. is below 9,000 ft. at 1 Winters, C SW SW 16. This is in the extension area of North Lindsay pool. In the same area Anderson-Prichard 1 Haney unit, C SW NE 20 is below 5,785 ft. in shale. W. B. Osborn has another well to start in 21-5n-4w.

Sinclair Oil & Gas Co. 1 Newcomb unit, C NE SW 17, which flowed 718 bbl. of oil in 13 hours through ⅛-in. choke from second and third Bromide perforations at 11,172-11,338 ft., has reduced the nonproducing area between Northwest and North Lindsay pools. First Bromide pay was also proved at 1 Rayburn unit in C SW NE 18-5n-4w. This well flowed oil at the rate of 522 bbl. per day for a 40-minute period through 26/64-in. choke from 11,137-177 ft. Deeper zones also indicated pay. The well is in completion stages.

Second Well Finds Oil In Northeast Cleveland

Calvert Drilling Co. 2 Foster, SE NE NE 14-10n-1e, Cleveland County, the second well in an indicated new pool, recovered 1,470 ft. of oil plus 270 ft. oil-cut mud on drill-stem test at 6,092-6,102 ft. in the First Wilcox sand.

The 1 Foster, NE NE NE 14-10n-1e, had water encroachment, and was a failure.

New Structure Found Southeast of Coyle

Another Wilcox sand pay structure is being proved southeast of Coyle in eastern Logan County.

Zephyr Drilling Corp. 1 House, SE SE NW 35-17n-1e, is due production tests after indicated Hunton, first and second Wilcox pay. A drill-stem test at 4,818-30 ft. in the upper Hunton flowed gas in 2 minutes at rates of 7,000 M.c.f. per day plus distillate. Gas also flowed from the upper first Wilcox sand at 5,141-61 ft. Recovery was 1,450 ft. of free oil and 240 ft. salt water. A test at 5,280-85 ft. in the top 5 ft. of the second Wilcox flowed gas in 24 minutes. Recovery was 2,940 ft. of oil, 15 ft. of oil-cut mud, and 15 ft. of brackish water.

There are a number of pools around the Coyle area. South Central School pool production is from the Hunton lime and first Wilcox sand. The new Zephyr well is set apart from second Wilcox sand production to the north by a dry hole.

Confirmation Test at Cleveland Strike Flows

West Helsel pool's confirmation test in southeastern Cleveland County has been proved for second Wilcox sand production.

Ashland Oil & Refining Co. 1 Walker, C NE SW 19-7n-1e, flowed gas in 10 minutes and oil in 1 hour, 14 minutes with no estimate of the flow rate on drill-stem test at 6,983-95 ft. Recovery was 6,500 ft. of oil.

The field's discovery well, Ashland 1 Nance, SW SE NW 19, flowed 205 bbl. of oil per day from perforations at 6,989-7,002 ft. through 16/64-in. choke.

Southwest Yale Pool in Payne County is Extended

Southwest Yale pool, Payne County, has been extended ½ mile east at Lichlyter, Barnett & Stone 1 Lauderdale, SW SW NE 25-19n-5e.

The Red Fork extension well flowed at the rate of 5 to 7 bbl. of oil hourly following fracturing and is shut-in for tankage. Perforations were at 3,076-91 ft.

Another field well, a flank producer, has been completed by Thomas N. Berry at 1 Lauderdale, NW NW SW 25. The Red Fork well is flowing 10 bbl. of oil hourly through 16/64-in. choke. Carl Crites 1 Merritt, SE NW SW 19-19n-6e, is another extension well, this one to Yale-Quay field. This well was finaled for a flow gage of 7 bbl. of oil hourly through Red Fork perforations at 3,110-36 ft. on 6/64-in. choke.

Oil Discovery Well in Okfuskee Area Completing

Wilcox Oil Co. is completing a new oil discovery at 1 Cumseh, NW NW SE 10-12n-10e, Okfuskee County. The well is the offset to a gas well which has Dutcher sand production. The new oil strike has Wilcox sand production. Recovery on a drill-stem test at 3,570-90 ft. was 275 ft. of heavily oil and gas-cut mud, estimated 50 to 70 per cent oil.

The new discovery is the east offset to Russell B. Patterson 1 Sporleder, completed late last year for 18,100 M.c.f. of gas per day from the Dutcher sand through perforations at 2,790-2,803 ft. The well has been shut-in since.

Plug Being Drilled at South Central School

Zephyr Petroleum Corp. is drilling plug at 1 House, SE SE NW 35-17n-1e, stepout northeast of Logan County's South Central School pool.

Recovery on a drill-stem test at 5,280-85 ft. was 2,940 ft. of oil on top of the second Wilcox sand. The first Wilcox sand flowed an estimated 750 M.c.f. of gas and recovered 1,450 ft. of oil on test at 5,141-61 ft. The Henton lime flowed gas at the rate of 7,000 M.c.f. per day with some distillate on drill-stem test at 4,818-30 ft.

The pool's production is from the Hunton and first Wilcox.

Production in Logan Area Is Linked by Good Wells

The area between West Edmond and Northeast Lockridge pools in Logan County has been linked by good wells. Powell Briscoe 1 Reed, C NE NE 33-15n-4w, about ½ mile from production in both pools, flowed 480 bbl. of oil in 24 hours through an 18/64-in. choke from the Hogshooter and 96 bbl. in 24 hours through 3/64-in. choke from the Layton.

Briscoe's 3 Brouchoud, in Northeast Lockridge pool, is drilling below 4,226 ft. Peppers 1 Gaffney, SW SW SE 21, is being completed, and a stepout ½ mile north of production is drilling at Harper-Turner 1 Brouchoud, SE SW NE 21-15n-4w.

KANSAS

Viola Oil Shows to be Tested at Harper Wildcat

Beardmore Drilling Co. has 5-in. casing set to test Viola lime oil shows at its 1 Berg, rank wildcat 12 miles southeast of Grabs pool in Harper County, southern Kansas.

The test, located in SW SW SE 29-32s-7w, recovered 1,650 ft. oil and 350 ft. of muddy, gassy oil on drill-stem test at 4,756-64 ft. No shows were encountered in the deeper Simpson or Arbuckle.

Six New Pools Opened

Kansas operators finaled six new pool openers in the state. In eastern Kansas Gross Drilling Co. finaled 1 Stewart, NW SW SE 6-29s-5e, Butler County, for a pump potential of 25 bbl. of oil per day from the Bartlesville sand.

In the extreme southern part of the Salina basin in McPherson County two new pools were opened. S. J. Carter and Trans-Era Petroleum 1 Myers, SW SW SE 19-19s-5w, was completed for a potential of 400 bbl. of Mississippian oil per day. The 1 Neel, NE SW NE 30-19s-5w, was completed for a pump potential of 175 bbl. of oil daily from the Mississippian.

On the southwestern tip of Central Kansas uplift in Pratt County H. L. Moore 1 Williams, SE SW NW 29-26s-13w, was completed for 164 bbl. of Simpson oil daily. On the uplift itself Eddie Fischer completed 1 Fischer, SE SE SE 8-9s-17w, Rooks County, for a potential of 25 bbl. of Arbuckle oil per day.

Northwestern Kansas' Sheridan County has a new Lansing pool at Sauvage & Dunn 1 Brantley. This test was finaled for a pump potential of 80 bbl. of oil per day. It is located in the SE SE SE 16-6s-29w.

MICHIGAN

Deepening to the Trenton at the W. C. Taggart 3 Wilson-Buers, NW SE SW 1-1s-7e, Salem Township, Washtenaw County, was at least being temporarily delayed as drilling crew experienced difficulty in getting inside a part of a string of 8-in. casing which was left in the hole when this well was originally drilled and abandoned as a failure in the Salina.

This old well, which was originally drilled to about 3,220 ft., is located just ½ mile due west of the Taggart 1 LeMaster, Trenton oilwell discovery, which was continuing to be flowed at about 200 to 220 bbl. of oil a day through a ¼-in. choke. The discovery well is bottomed out in Trenton dolomite pay at 4,397 ft.

When this older and shallower hole was opened and tools had been threaded into the

stub end of this string of 8-in. casing which was left in the hole, about 750 ft. below the surface, it was no trick to circulate and clean the hole out to its orginal total depth. But every time a trip was made, drillers experienced difficulty in again getting inside this casing. Only about 54 ft. of new hole appeared to have been cut, and a show of gas, probably in the Niagara was logged and a drill-stem test was run, but only 30-ft. of gas cut mud was recovered. An effort to run a string of 7-in. casing to clean up this so-called "threading" difficulty failed. Taggart, it appeared, was scheduled to try to drill additional hole with rotary tools before resorting to running a string of 5-in. casing. It was thought that he probably wanted to try to get as close to the Trenton objective as possible before running small diameter casing which will, when run, no doubt force standardization and completion with cable tools.

Tests of a show of oil in the Traverse at the McClure Oil Co. 1 Kohn, SE SE NW 1-12n-10w, Reynolds Township, Montcalm County, was being run this week. Wildcat carried a bailer and one-half of free oil natural in 6 hours from Traverse pay drilled at 2,782 ft. (top of objective) and 2,792 ft.

CANADA

Gas-Condensate Strike Reported at Buick Creek

Natural gas and some condensate has been discovered by Pacific Petroleums, Ltd., and Union Oil Co. of California at their joint wildcat in the Buick Creek area of northeast British Columbia. This exploratory driller, situated about 45 miles northwest of Fort St. John, struck its production in a zone believed to be the Triassic.

The discovery came at Pacific-Union 1 Buick Creek, on approx. Section 31 in Township 108w6, about 15 miles northwest of the N.F.A. 2 Buick Creek capped potential gas well. The Triassic was contacted at around 3,900 ft., and the gas came during drill-stem test of the interval 4,695-4,720 ft. Natural gas flowed in about 5 minutes, at maximum rate 2,630,000 cu. ft. daily, and recovery was 200 ft. of muddy condensate. Testing is now continuing at 4,760 ft.

Ardley area . . . A group of six American and Canadian companies, headed by Stanolind Oil & Gas Co., has discovered a moderate flow of natural gas from the D2 Devonian zone at a wildcat on unitized lands in the Ardley area of central Alberta. This new strike lies west of the Nevis-Stettler region, and is about 90 miles northeast of Calgary.

The well, Stanolind et al 1 Ardley unit well, LSD 3, 18-38-23w4, is 7 miles west-southwest of the Gulf 6 Allison D3 Devonian wet gas and oil discovery well. The Ardley wildcat contacted D2 at 5,730 ft., or 3,042 ft. subsea, and a 70 minute drill-stem test from 5,762-78 ft. flowed gas to surface in 5 minutes at rate 1,500,000 cu. ft. daily. Fluid recovery was 80 ft. of sulfurous muddy water. There are an estimated 5 ft. of pay zone present at this site.

Saddle Hills . . . The team of Royalite Oil Co., Ltd., and Canadian Fina Oil, Ltd., have successfully completed their Cadotte sand gas discovery well in the Saddle Hills area of northwest Alberta, 32 miles northwest of Grande Prairie and 45 miles east-southeast of Dawson Creek, B.C. After plugging back and perforating opposite the gas sand, the discovery rated an open flow potential of 4,000,000 cu. ft. daily.

The well, Royalite-Fina 1 Saddle Hills, LSD 11, 4-76-8w6, is about 25 miles southwest of Rycroft area gas wells and that same distance southeast of Gordonale gas wells. Hole was drilled down to 6,285 ft. to test lower formations. The Cadomin horizon gave up only a noncommercial gas showing, so hole was plugged back for production tests in the Cadomin. The interval 3,857-67 ft. was perforated, and during test flowed gas at rate 4,000,000 cu. ft. daily. Top of the Cadotte was found at 3,856 ft., or 886 ft. subsea, and drill-stem tests flowed gas at rates in excess of 5,000,000 cu. ft. daily. There were an indicated 30 ft. of gas zone present above the water. The McIntyre & Webster Drilling Co., Ltd., rig is now being moved about 2½ miles northwest for immediate start at Royalite-Fina 2 Saddle Hills, LSD 11, 4-76-8w6.

CALIFORNIA

Deep Mountain View Wildcat Started

General Petroleum Corp. was preparing to move in equipment for a deeper zone test on the western edge of Mountain View field near Bakersfield. The wildcat, scheduled to about 10,000 ft. in search of Vedder sand production, will be 15-24 Guimarra in NW SW 24-30s-28e. Site is about ½ mile southeast of the 7,300-ft. Wible sand pool discovered in April last year.

The wildcat is being drilled on a 160-acre farmout obtained from M J M & M Oil Co. According to terms of the farmout the test was to be spudded by March 1. Union Oil

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Co., Pacific Western Oil Corp., and Universal Consolidated Oil Co., all of which hold acreage in the vicinity of the test, are supporting the wildcat.

Extension Tests Evaluate Guijarral Hills Find

The Leda sand pool discovered by Union Oil Co. on the northeast edge of Guijarral Hills field, Fresno County, is being evaluated by two extension tests.

Two locations southwest of the 8,850-ft. discovery Los Nietos Co. 81-34-8 Allison was coring below 8,700 ft. Originally completed in the Allison pay above 8,400 ft. by Sunray Oil Corp., it is the furtherest northeast producer in the older part of the field. In NE SE 27-20s-16e, two locations northwest of the discovery, Standard Oil Co. of California had moved in equipment to start its 85 "Well."

West of the field 1½ miles Standard was making slow progress in washing over stuck pipe in its 3 33-F, which has indicated it will extend production of the one-well West Guijarral Hills field two locations east. Only about 15 ft. of pipe remained to be freed at last reports. Indicated production is from the Leda sand at 8,325-60 ft.

APPALACHIAN AREA

WEST VIRGINIA

In Union district, Preston County, West Virginia, Columbian Carbon Co. 1-GW-1195 Ethel Mullenax, rank wildcat, elevation 2,635 ft., resulted in a dry hole. Tully 5,255-5,282 rt., TD 5,526 ft. Considerable difficulty was encountered in drilling to this depth. The 1-GW-1196 Robert Breedlove, is at a depth of 5,050 ft., in the Oriskany sand which was reached at a depth of 4,922 ft. A show of gas in the chert at 4,817 ft., tests 43,000 cu. ft.

OHIO

James Shearer et al completed another producer in Shearer pool in Bethlehem Township, Coshocton County. The 4 Charles Fox, 2nd Qr., made a good showing natural in Clinton found at 3,390-3,438 ft., and increased to 330 bbl. in 24 hours after fracturing.

Oxford Oil Co. 1 (2) Mary Fleming, Lot 29, Perry Township, Licking County, ¼-mile from production, made 55 bbl. after fracturing sand, found at 2,944-2,991 ft. In Madison Township, Ohio Fuel Co. 1 W. D. Hickey, Lot 7, topped the Newburg sand at 2,086 ft. and was drilled to 2,095 ft. where the gage was 1,750,000 cu. ft. natural. This is the first offset to the discovery on Frank Kreager.

KENTUCKY

EASTERN KENTUCKY

In Breathitt County, and located on Carpenters Branch of Quicksand Creek, S. C. McCoun has completed 2 Lenville Carpenter as a gas producer from the Corniferous lime. An open flow potential of 119,000 cu. ft. of gas. Well produced naturally from top of formation at 1,766 ft. to 1,789 ft. 70,000 cu. ft. of gas was had in the Big Six (Silurian) sand 1,964 to 1,968 ft. total depth.

In Whitley County, and located on Clear Fork of Cumberland River, Dr. Daniel Bower has completed 1 Scott for 660,000 cu. ft. of gas daily from the Big Lime (Mississippian) formation at a total depth of 1,289 ft. Flow was natural and a 24-hour rock pressure indicated 270 lbs.

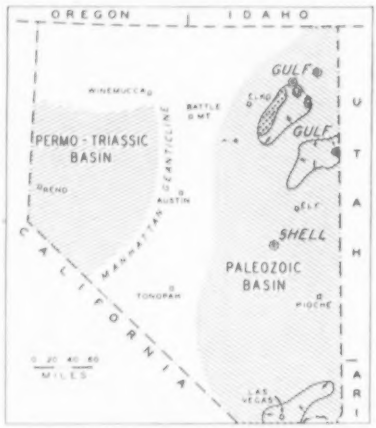
ROCKY MOUNTAIN

NEVADA

Shell Tests Apparent Discovery in Nye County

Shell Oil Co. recovered apparently commercial quantities of oil from an unidentified formation in Nye County. The well, if commercially completed will be the state's first commercial producer and will add Nevada as 29th on the list of oil producing states. The well is 1 Unit, SE NE NW 35-9n-57e, in the Eagle Springs area 65 miles southwest of Ely and about 170 miles northeast of Las Vegas.

Test of the zone 6,453-6,533 ft. recovered a total fluid column of 2,771 ft., or the equivalent of 31 bbl. Net rise was 24.75 bbl. of which 23.6 bbl. was oil, 0.7 bbl. was oily, muddy fresh water and 0.4 bbl. was oil and



Shell Oil Co. is re-running drill-stem test of the zone 6,533-83 ft. at 1 Unit, SE NE NW 35-9n-57e, in the Eagle Springs area of Nye County. Gulf Oil Corp. is drilling below 6,000 ft. at its Wells area wildcat and is below 5,950 ft. at its Thousand Springs wildcat in Elko County.

sediment. Oil recovered was 2.59°-gravity and had a pour point of approximately 80°. No analysis has been reported by the operator but the crude is reported as apparently of good quality.

Shell cored from 6,533-83 ft. with recovery of medium hard pyroclastics and agglomerates, showing oil. At last report the operator was running test of this zone after previous attempts to test were defeated by packer failure.

Shell, Gulf Oil Corp., Continental Oil Co., and Standard Oil Co. of California have been the most active companies in the desultory postwar exploration of Nevada. A great many additional operators were reported actively leasing through the state following the report of Shell's recovery of oil at the Eagle Springs wildcat.

The well is within the Basin and Range Province which extends from western Utah through much of Nevada and roughly from Arizona to Idaho in a north-south direction. It consists of a series of north-south ranges separated by relatively narrow valleys all of which are of increased interest following the apparent success in Nye County.

A majority of postwar drilling in the state has been in the general White Pine County area about 180 miles north of the Shell well. No encouragement has been had from this previous drilling.

ARIZONA

Apache County Wildcat Drilling Ahead

Shell Oil Co. is drilling below 5,860 ft. at 1 Navajo, C SE SE 6-41n-29e, Apache County with top of Leadville reported at 5,546 ft. The well had oil and gas shows through a substantial section of the Pennsylvanian Hermosa. Recoveries of gas on tests through the formation ran as high as 100,000 cu. ft. per day, with gas and oil-cut mud recovered from several zones. Shell has done no extensive testing of the formation. The wildcat is considered one of the most encouraging to date in Black Mesa basin prospects.

NORTH DAKOTA

New Bottineau County Pool a Possibility

Dakota Drilling Co. of Bismarck recovered 400 ft. of free oil in 2½-hour test of the zone 4,092-4,125 ft. at 1 Anderson, C SE NW 19-161n-81w, Bottineau County. The test was tentatively identified as in Mission Canyon. In addition to the oil the test recovered 90 ft. of slightly gas-cut mud, 180 ft. of oil and gas-cut mud, 90 ft. of oil mud, 180 ft. of muddy oil and 510 ft. of sulfur water. Flowing pressure was 50-550 psi. Top of pipe line at 3,400 ft. was the last reported.

The well is slightly more than 14 miles southwest of previous production in the county. It is scheduled as a 6,700-ft. test to Silurian and according to current reports by the operator, will be taken to that objective regardless of nature of higher shows.

Carsin Area Wildcat Has Basal Mississippian Show

Carter Oil Co., Sinclair Oil and Gas Co., and Socony-Vacuum Oil Co. reported recovery of a small quantity of free oil on test of Bakken (Basal Mississippian) at their joint wildcat, 1 Lockwood, C SE SW 5-147n-93w, in the Carsin area of Dunn County. A recovery of 30 ft. of free oil, 810 ft. of oil and gas-cut water cushion, 400 ft. of oil and gas-cut mud and 1,080 ft. of water cushion was made with tool open 5 hours in the interval 10,370-10,444 ft. Top of Bakken was reported at 10,379 ft.

The operator is coring ahead below the tested interval. This formation has had shows in previous North Dakota wildcats, but no free oil has been previously reported from it.

WYOMING

Fremont County Wildcat Finds Oil

Skelly Oil Co. recovered 820 ft. of oil on test of the zone 3,261-88 ft. at 1 Tribal, SW SW SW 36-6n-3w (WRM) in the northwest Sheldon Dome area, Fremont County. Test was of the Curtis sand. Another test 3,287-3,329 ft. recovered 420 ft. of oil and 180 ft. of mud-cut oil.

Tops have not been reported by the operator and logs are being run with total depth at 3,384 ft. The well is about 4 miles northwest of Sheldon Dome production and about 5 miles southwest of Circle Ridge field.

Weston County Wildcat Flows

Dakamont Exploration Co. reported a flow of 20 bbl. of oil per hour following fracture

of Newcastle sand in 1 Government, C NE SE 21-41n-67w, in the Sherwin Ranch area of Weston County. The well perforated in the interval 8,105-33 ft. A second well, ¼-mile north of the discovery has already been spudded by this operator. The discovery extends production in the Clareton trend about 2 miles to the west.

Niobrara County Discoveries Testing

Vickers Exploration Co. recovered 500 bbl. of oil in 20 hours on test of 1 Government, C NE NE 32-41n-66w, Niobrara County, Wyoming. The well was perforated 7,645-57 ft., acidized and sandfract prior to testing. It is 2 miles northwest of the Cosden Petroleum Co. et al discovery in C NW SW 3-40n-66w, first Newcastle sand producer in the county.

Further south C. G. Glasscock has shut in 1 Government 41-33, C NE NE 33-39n-65w, according to unofficial reports. The well is a tight hole and the operator has neither confirmed or denied reports of a discovery. Casing was landed at 7,590 ft., and the well is reported to have flowed following fracture.

WESTERN NEBRASKA

Deep Cheyenne County Test Finds Lyons Sand Absent

Ohio Oil Co. has plugged back for Cretaceous completion at WSGP 22 Chambers 1, SE SW SW 14-13n-51w, in the West Sidney area of Cheyenne County. The well was drilled to 6,113 ft. total depth to test Lyons (Permian) sand. The sand was not developed and Ohio will complete the well as a "J" sand oil producer.

COLORADO

Logan County Discovery Completed

Sunray Oil Corp. completed 1 Knudson, NW NE NW 6-8n-52w, Minto area discovery Logan County for a flow of 207 bbl. of oil per day through ¼-in. choke. Production is from "J" sand, topped at 4,797 ft. The discovery is 4 miles northwest of Sterling.

Weld County Wildcat Flows

Cortlandt Dietler and S. D. Johnson tested a flow of oil estimated at 50 bbl. per hour at 1 Spinner, C NE NE 35-6n-61w, Weld County. Test was of the "D" sand interval 6,669-84 ft. Oil produced was 40°-gravity, under flowing pressure of 1,000-1,225 psi. The well is about 1½ miles south of the older Greasewood field. The reported flow was on drill-stem test and the operators are now preparing to complete.

TEXAS

NORTH TEXAS

Clay Wildcat Is Strawn Discovery

Warren Petroleum Corp. 2 Bowen Estate, west of Shannon in southwestern Clay County, flowed 150 bbl. of 40° oil a day through ½-in. choke on potential test. Pay section was perforated from 3,301-05 ft. Warren staked location for 1 Hattie Watson as a southeast offset and confirmation well.

Nolan County . . . Seaboard Oil Co. 13-A Billie Hanks, new pay discovery in Hylton, Northwest field, has added Pennsylvanian reef as the third pay zone in the area. On potential test the well flowed 701 bbl. of 40° oil daily through ¼-in. choke from perforations at 4,486-4,506 ft. Other pays are the Fry sand and Stephens limestone, both of Strawn age.

The Chicago Corp. 2 TXL has been completed as the second producer for North Dora-Caddo field. Daily potential was 272 bbl. of oil a day through ⅜-in. choke from pay around 5,820 ft.

WEST TEXAS

Yoakum County Devonian Discovery Completed

Wellman & Sons et al 1-104 Field, Devonian discovery in the northwestern corner of Yoakum County, has been completed, and the same operators have filed application to drill a direct offset, and an extension test.

Operators picked top of the Devonian at 12,032 ft. on elevation of 3,870 ft. A 10-hour test after perforating and acidizing from 12,040-12,060 ft. developed a flow of 650 bbl. of clean oil in 10 hours through 28/64-in. choke. Completion potential was reported as 1,560 bbl. daily from perforations at 12,040-12,060 ft. and open hole at 12,060-12,107 ft.

Scurry Test Is Extension And New Pay Discovery

Fred Goodstein 1 Mathis, in the Winfield-Ellenburger area northwest of Fluvanna, Scurry County, had prospects of extending Ellenburger production, plus adding a new pay in Pennsylvanian Strawn. Location in Winfield pool makes it a connecting link between the southernmost producer and the northern portion.

Top of the Strawn was logged at 7,772 ft., minus 5,032 ft. A drill-stem test between 7,915-54 ft. had oil at the top in 1 hour and 55 minutes, and made a short flow into pits before being shut in. Recovery in the pipe was clean oil, plus 700 ft. of sulfur water.

Operators drilled into the Ellenburger at 8,360 ft., minus 5,620 ft., then tested from 8,367-80 ft. Oil surfaced in 47 minutes and was flowed into pits for 13 minutes. No estimate was made on the rate of flow. Operators

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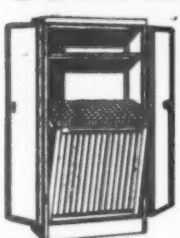

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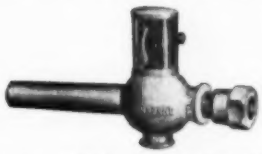

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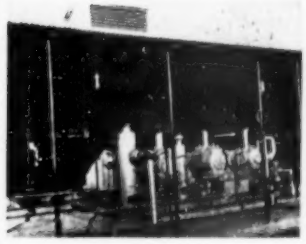

Archer County,
Texas
SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION
PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

were running casing on bottom to complete. Location is in 537-97-H&TC Survey.

Northeast of Snyder, Wheelock-Weinschel 1 Johnson was drilling below 7,431 ft. after finding oil and gas shows in Strawn limestone topped at 7,204 ft. A test open 2½ hours from 7,205-40 ft. in the Strawn produced 60 ft. of mud, 360 ft. of oil and gas-cut mud and 180 ft. of salt water.

Ector County . . . Phillips Petroleum Co. 2 Ratliff, Pennsylvanian Bend limestone discovery in MacBoring-Wolfcamp field, has been completed for a daily potential of 246 bbl. of 41°-gravity oil a day. Completion gage was through ¼-in. choke from perforations between 10,620-10,696 ft.

Texas Gulf Producing Co. 8 Headlee, long southeast extension to Headlee-Ellenburger field, has been completed from pay topped at 13,130 ft. On completion test the well flowed 506 bbl. of oil in 12 hours through 16/64-in. choke.

TEXAS GULF COAST

Pledger Extension Well Records Large Gas Flow

Completion of a well flowing at the rate of 149,300,000 cu. ft. of gas daily has been recorded by Humble Oil & Refining Co. in the Pledger area, of Brazoria County.

The well, 2 Carter, is located northeast of production in the field, being 4,000 ft. from Humble's 1 Carter, nearest other production. The gas carried a spray of 49.2°-gravity condensate. Pay interval is at 6,792-6,810 ft. with bottom of the hole at 6,915 ft.

New Big Hill Producer Has Prolific Gas Flow

Delta Drilling Co. has a 200,000,000-cu. ft. dry gas well in the upper of two Frio sand zones in which it will complete dually its 2 Security Bank, deep test in the Big Hill area, Jefferson County. The zone is open through perforations at 10,360-74 ft. Following the open-flow potential gage, the flow was shut in with pressure of 3,770 psi. Tests now are under way in a deeper zone at 10,468-82 ft., also showing for prolific gas production. The well was drilled to 10,557 ft. Delta has location for 3 Security, 933 ft. northwest of 2 Security.

In the same general area, Deep South Oil Co. of Texas has completed its 7 Security Bank with an open-flow potential gage at the rate of 5,400,000 cu. ft. of gas daily from Frio pay at 10,129-35 ft. The gas yielded 44.9°-gravity condensate with a gas-liquid ratio of 295,000 cu. ft. per barrel.

Amelia Wildcat Uncovers New Hackberry Oil Field

Discovery of another oil-producing area, located 1½ miles southwest of Amelia field, west of Beaumont, in Jefferson County, has been established with the completion by Clegg & Hunt and associates of their 1 Phelan, in Section 14, W. R. Hebert Survey.

On potential gage through ⅜-in. choke, the well flowed 170.50 bbl. of 41.5°-gravity oil per day under pressure of 1,330 psi. with gas-oil ratio of 857 cu. ft. per barrel. Production is from Frio-Hackberry sand at 7,836-40½ ft. Bottom of the hole is 8,233 ft.

The discovery has been named Phelan field.

Drilling is under way at the first confirmation test, 2 Phelan, 933 ft. east of the discovery well.

WILDCAT COMPLETIONS

SOUTHWEST TEXAS

Dimmitt County: C. H. Clark and O. A. Owen 2 Standifer, J. Pointevent Sur. 35, A-649. Dry. TD 1,120 ft.

Duval County: Plymouth Oil Co. 1-B Leroy Denman, Jr., Santos Garcia Grant, A-91 (Longhorn area). Dry. TD 6,977 ft.

Pontiac Refining Co. and Arnold O. Morgan 1 Bebe Denman, Lot 4, Sec. 46, Realitos Subd., Copita Farm & Garden Tracts. Dry. TD 5,834 ft.

The Texas Co. 1-B DCRC NCT-31, BS&F Sur., 99. Dry. TD 2,110 ft.

Frio County: Fred W. Shield 1-7 Unit Oppenheimer & Long, BS&F Sur. 7, A-123. Dry. TD 5,569 ft.

Hidalgo County: Superior Oil Co. 1-B Hamman, Blk. 264, Jackson's Subd., Melado Tract, San Salvador del Tule Grant. IP 1,470 M.c.f. daily, open-flow potential, perforations 8,326-36 ft. TD 10,440 ft. (New field—North Monte Cristo.)

Kenedy County: Standard Oil Co. of Texas 22 State Lease 40, Tract 370, Laguna Madre. Dry. TD 10,034 ft.

LaSalle County: Yount-Wade, Inc., 1 Coleman, I&GN Sur. 11. Dry. TD 5,468 ft.

Nueces County: Renwar Oil Corp. 1 Poenisch, Lot 24, Flour Bluff Encinal Garden Tracts. Dry. TD 6,715 ft.

Southern Minerals Corp. 2 Johnson, Sec. 125, George H. Paul Subd., Driscoll Ranch. IP 13.8 BOPD, ⅛-in., 38.8°, perforations 5,157-71 ft. TD 6,709 ft. (New field.)

Texas Crude Oil Co. and Kirkwood & Morgan 1 Milstead, Sec. 42, John J. Elliff Subd. Dry. TD 6,015 ft.

San Patricio County: Burdette Graham et al 1 Champlin, Sec. 52, George H. Paul Subd. Dry. TD 9,022 ft.

Starr County: Porcion 71, Blk. 20, T. R. Cunningham Subd. Dry. TD 432 ft.

Webb County: Killam & Hurd et al 1 Garcia, Sur. 338. Dry. TD 3,218 ft.

J. Ray McDermott, Inc., 1-A Marrs McLean Trust, Blk. 2, CCSD&RGNG Sur. 69, A-1057. Dry. TD 7,570 ft.

Wilson County: Bill Forney 1 Guajardo, Josa de la Garza Sur., A-14. IP 363.62 BOPD, ½-in., 24°, Austin Chalk 2,875-2,932 ft. (open hole). TD 2,032 ft. (New field.)

H. H. Howell 4 Evans, Jose F. Rodriguez Sur. Dry. TD 4,815 ft.

Zapata County: Dulaney Oil Co. 3 Amalia de Vela, Blk. 13, Don Adams Subd., El Grullo Grant. Dry. TD 3,368 ft.

TEXAS GULF COAST

Austin County: Sun Oil Co. 1 Beamon, J. Furnash Sur., A-40. Dry. TD 11,460 ft.

Bee County: Jake L. Hamon and Edwin L. Cox 1 Wilson, Timothy Hart Sur., A-28. IP 50,000 M.c.f. daily with 8.6 BC per M.M.c.f., open-flow potential, perforated 5,166-68 ft. TD 6,416 ft. (Extends Massengill field).

Brazoria County: J. Ray McDermott & Co., Inc., 1 Hurlock, HT&B Sur. 55, A-286. Dry. TD 4,540 ft.

Chambers County: Sun Oil Co. 1 Jackson, J. Whitcomb Lge., A-27 (South Oyster Bayou area). Dry. TD 10,800 ft.

Fayette County: M. M. Miller et al 1 Janda, David Berry Lge., A-15. Dry. TD 3,821.

Fort Bend County: Wagner-Werner Co. 2 George, Peter Teal Sur., A-337. Dry. TD 8,015 ft.

Goliad County: Vaughn, Zoch & Turnbull 1 Calhoun, Maria de Jesus y Barbo Sur. Dry. TD 8,013 ft.

Hardin County: L. D. Cain 1 Gulf Hopkins fee, Tract 24, Mary Hopkins Sur., A-779. IP 229.70 BOPD, 10/64-in., 31.3°, Cook Mountain 7,532-46 ft. and 7,548-62 ft. (perforations). TD 7,620 ft. (New pay in West Saratoga field).

Ted Weiner and Arthur O. Wellman & Sons 1 Kirby, B. H. Hawkins Sur., A-600. Dry. TD 7,506 ft.

Harris County: Humble Oil & Refining Co. 1-C Hermann Hospital est., William C. Perkinson Sur., A-653. Dry. TD 8,515 ft.

Jasper County: Ada Oil Co. and Hurt Oil Co. 1-A Hardy Richardson heirs, Elisha Morris Sur., A-28. Dry. TD 7,858 ft.

Jefferson County: San Juan Exploration Co. and Holmes Drilling Co. 1 Janes, M. Chirino Sur. Dry. TD 8,484 ft.

Live Oak County: Morris Cannan 1 Wendel-Schluter-Tullis, Nelson Owen Sur. 56, A-313. Dry. TD 8,537 ft.

Madison County: J. B. Stoddard 1 Tinkle, J. Bozeman Sur. Dry. TD 9,652 ft.

Refugio County: Kirkpatrick & Coates 1 Thomas, Johnson & Pugh Subd., Section 45. Dry. TD 6,752 ft.

Orange County: Sun Oil Co. 1 Price, N. Bonner Sur., A-38. Dry. TD 10,065 ft.

Wharton County: Progress Petroleum Co. of Texas 1 Halmicek, BBB&C Sur. 3, A-77. Dry. TD 6,012 ft.

EAST TEXAS

Freestone County: C. L. Brown 1 Goolsby heirs, S. P. Flint Sur., A-228. IP 700,000 cu. ft. gas, open flow, Rodessa 6,481-88 ft., GOR 40,000 cu. ft. IP 1,160,000 cu. ft. gas, open flow, Pettit 7,097-7,100 ft., GOR 25,000 cu. ft. TD 7,168 ft.

Hill County: C. A. Lee Drilling Co. 1 Henry Hight, M. Caddell Sur. Dry. TD 1,500 ft.

Hunt County: B. B. Banner 1 Maude Burnett, C. A. Warfield Sur. Dry. TD 3,107 ft.

TEXAS PANHANDLE

Hansford County: Humble Oil & Refining Co. 1-B Collier, 1-35-WCRR Sur. IP 14,100,000 cu. ft. gas, pay 4,586-4,607 ft. TD 5,180 ft.

WEST CENTRAL TEXAS

Callahan County: Gilchrist Drilling Co. 1 Kennard, Sec. 25, ETRR Sur. Dry. TD 2,470 ft.

Gilchrist 1 Windham, Sec. 10, ETRR. Dry. TD 2,404 ft.

Coleman County: Bay Petroleum Corp. 1 Deprang, Sec. 4, EL&RR. Dry. TD 3,905 ft.

H. A. Birdwell & Son Drilling Co. 1 Brannon, Samuel Sprague Sur. 659. IPP 43 BOPD, 41°, pay 1,580-85 ft. TD 1,619 ft.

G. B. Cree 1-F Morris, E. T. Harbow Sur. 152. Dry. TD 2,780 ft.

H. C. McDaniel 1 Williams, John W. Rhine Sur. 629. Dry. TD 1,375 ft.

Fisher County: The Texas Co. 1 Drake, 117-1-H&TC. IP 653 BOPD, 24/64-in., 42°, Caddo 5,856-74 ft. TD 6,185 ft.

Haskell County: Jones & Stasney 1 Smith, Sec. 26, BBB&C Sur. Dry. TD 3,755 ft.

Jones County: Central Well Servicing Co. 1 Lassetter, 17-4-H&TC. Dry. TD 3,632 ft. Miami Operating Co. 1 Massey-Wilson, Lot 61, DeWitt CSL Sur. 126. Dry. TD 4,997 ft.

Sojourner Drilling Co. 1 Roberts, Sec. 8, OAL Sur. Dry. TD 3,038 ft.

Stephens County: Gilland and Co. 1 Peeks, 19-7-T&P. Dry. TD 2,362 ft.

NORTH TEXAS

Archer County: Ada Oil Co. 1 Boone, SPRR Sur., A-408. Dry. TD 5,090 ft.

S. F. Hutchenson 3 Sallie Hutchenson, Blk. 142, John Harris Subd. Dry. TD 1,428 ft.

Hutchenson 1 Powell, Blk. 141, Harris Subd. Dry. TD 1,181 ft.

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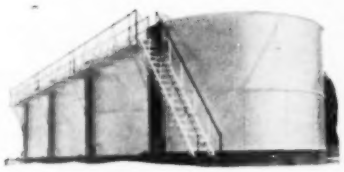

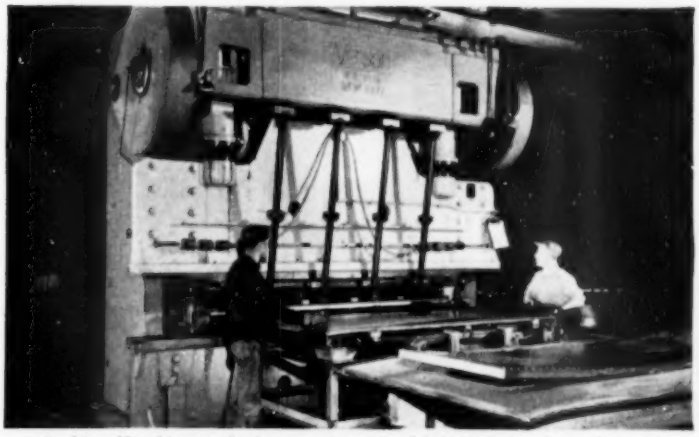

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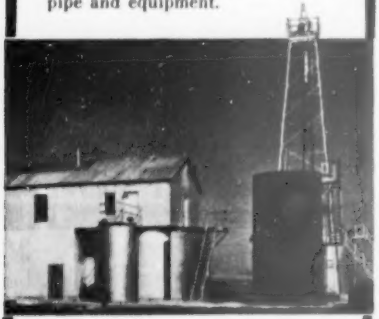

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WILDCAT COMPLETIONS

Texo Oil Co. 1 Petrex, Lot 4, Blk. 103, ATNCL Subd. Dry. TD 1,594 ft.

Baylor County: Y B Drilling Co. 3-B Burrell Mills, TE&L Sur. 2413, A-464. Dry. TD 1,434 ft.

Clay County: L. T. Burns 2 Della Keen, TE&L Sur. 2698, A-528. Dry. TD 5,781 ft.

Cooke County: Kay Kimbel 1 Woods, E. Spencer Sur., A-922. Dry. TD 5,257 ft.

Grayson County: A. R. McElreath estate and J. W. Carter 1 Varley, J. W. Rich Sur., A-1034. IPP 65 BOPD, 27°, pay 3,599-3,609 ft. TD 5,406 ft.

Hardeman County: Gulf Oil Corp. 1 Dodson, 280-A-H&TC. Dry. TD 7,110 ft.

Jack County: Joe Blalack 1 Morrow, Samuel Moss Sur. A-400. Dry. TD 5,500 ft.

Cox Drilling Co. 1 Loving, J. Irwin Sur., A-1625. Dry. TD 3,440 ft.

Drill Well Oil Co. 1 Richards, BS&F Sur., A-2321. Dry. TD 3,375 ft.

Knox County: Humble Oil & Refining Co. 1-F McFaddin, 7-1-J. Poitevent Sur. Dry. TD 5,417 ft.

Ray-Harris Drilling Co. 1 Masterson Bros., 33-4-D&W Sur. TD 6,439 ft.

Wichita County: Milton Fish 1-C Jennings, Sec. 8, HT&B Sur. Dry. TD 1,033 ft.

Wilbarger County: J. G. Hancock 1-B Waggoner, Sec. 2, SPRR Sur. Dry. TD 2,000 ft.

Wise County: E. B. Clark 1 Wines, R. Gilliam Sur., A-342. Dry. TD 4,770 ft.

Young County: E. S. Brashear 1-C Jeffery, Blk. 51, TE&L Sur. Dry. TD 905 ft.

Brashear 2-C Jeffery, Blk. 51, TE&L Sur. Dry. TD 860 ft.

WEST TEXAS

Andrews County: Deep Rock Oil Corp. 1 Newton, 15-A19-PSL. Dry. TD 12,728 ft. Elev. 3,025 ft., Strawn 11,120 ft., Devonian 12,705 ft.

Stanolind Oil & Gas Co. 1-BN University, 8-5-University Sur. Dry. TD 14,325 ft. Devonian 12,704 ft., Ellenburger 13,952 ft.

Borden County: Russell Maguire 1 Beal, 4-27-H&TC. IP 417 BOPD, 17/64-in., Pennsylvanian pay 7,588 ft. TD 8,560 ft.

Crockett County: Pan American Production Co. 1 University M-40433, 6-39-University Sur. Dry. TD 9,189 ft. Elev. 2,598 ft., Ellenburger 8,181 ft., Wilberns 9,114 ft.

Garza County: Stanolind Oil & Gas Co. 1 Bird, 82-5-GH&H. Dry. TD 8,542 ft. Elev. 2,466 ft., Pennsylvanian 7,482 ft., Ellenburger 8,170 ft., pre-Cambrian 8,498 ft.

Hockley County: DeKalb Agricultural Association 1 Smith, Labor 18, Lge. 696, State Capitol Lands Sur. Dry. TD 4,578 ft.

Kent County: Sun Oil Co. 2-F Wallace, 24-98-H&TC. Dry. TD 6,893 ft.

Mitchell County: Laan-Tex Oil Co. 1 Smith, 33-27-T&P. Dry. TD 3,102 ft.

J. H. Snowden 1 Powell, 37-29-T1S-T&P. Dry. TD 3,503 ft.

A. O. Wellman & Sons et al 1 Blassingame, 39-27-T&P. Dry. TD 7,961 ft. Elev. 2,149 ft., Caddo 7,130 ft., Ellenburger 7,750 ft.

Runnels County: Robert S. Lytle 1 Spill, B. F. Lollar Sur. 322, A-1264. Dry. TD 4,501 ft. Elev. 1,927 ft., Gardner 4,314 ft.

Schleicher County: Carter & Carter 1-A Sheen Bros., Sec. 6, C. E. Tredwell Sur. IP 3,300,000 cu. ft. gas, pay 4,411 ft. TD 4,430 ft.

Delfern Oil Co. 1 Willoughby, Sec. 147, HE&WT Sur. Dry. TD 1,502 ft.

Sterling County: E. V. Headlee 1 Davis, 17-14-SPRR. Dry. TD 2,157 ft.

O. E. Schkade 1 Glass, 30-22-H&TC. Dry. TD 1,475 ft.

Sutton County: LaGorce Oil Co. 1 Hunt, 69-14-TW&NG. Dry. TD 6,412 ft. Elev. 2,322 ft., Strawn reef 5,155 ft.

Tom Green County: C. L. McMahon, Inc. 1 Bewolf, W. A. Threadgill Sur. 4. Dry. TD 5,870 ft. Elev. 2,324 ft., Ellenburger 5,654 ft.

Southern Minerals Corp. 1 Johnson, 36-25-H&TC. Dry. TD 5,853 ft. Elev. 2,261 ft., Ellenburger 5,622 ft.

Winkler County: Ralph Lowe 1-E Univeersity, 26-21-University. IP 222 BOPD, 20/64-in., 38°, pay 6,385 ft. TD 7,505 ft.

D. W. St. Clair 1 Sealy-Smith, 91-A-G&MMB&A Sur. Dry. TD 3,210 ft.

SOUTHEAST NEW MEXICO

Lea County: Neville G. Penrose, Inc. 1 Fair-Weather Unit, 3-15s-35e. Dry. TD 14,690 ft. Elev. 4,006 ft., Pennsylvanian 10,850 ft., Mississippian 13,660 ft., Siluro-Devonian 14,615 ft., Devonian 14,674 ft.

Phillips Petroleum Co. 1-A Federal, 21-13s-38e. Dry. TD 12,582 ft. Elev. 3,822 ft., Cisco 10,350 ft., Devonian 12,475 ft.

Stanolind Oil & Gas Co. 1-AC State, 31-16s-36e. Dry. TD 13,540 ft. Elev. 3,942 ft., Pennsylvanian 10,835 ft., Strawn 11,560 ft., Devonian 13,483 ft.

Stanolind 1-AF State. 3-17s-35e. Dry. TD 13,000 ft. Elev. 3,969 ft., Pennsylvanian 11,160 ft.

NORTHERN NEW MEXICO

Rio Arriba County: Lowry Oil 1 Jicarilla "A," C SW SW 11-24n-5w. Dry. TD 7,913 ft. Entrada 7,854 ft.

Stanolind Oil & Gas 3 San Juan 32-5, SW NE SW 10-32n-5w. Dry. TD 9,153 ft. Morrison 9,043 ft.

Sandoval County: T. H. Keaton 1 Cordova, SE NE NW 21-20n-1w. Dry. TD 985 ft.

ILLINOIS

Bond County: Calvert Drilling Co. 1 Folkers, NE NE SE 28-7n-2w. Dry. TD 3,336 ft.

Montgomery County: Ted Glass 1 Bergman, NE NE SE 9-9n-5w. Dry. TD 1,992 ft.

Ted Glass 1 Carter, NE NW SE 20-10n-5w. Dry. TD 1,903 ft.

MICHIGAN

Lenawee County: J. O. Mutch 1 Billmeyer, SW NW SE 5-5s-2e. Dry. TD 2,454 ft. in basal Salina-Niagaran.

Newaygo County: Ace Oil Co. 1 Peterson et al, SE SE SW 15-12n-14w. Dry. TD 2,195 ft. in Traverse lime.

FLORIDA

Dade County: Commonwealth Oil Co. 1 Wiseheart-State of Florida, 16-54s-35e. IPP 75 BOPD net, 21.3°, Sunniland lime 11,325-27 ft. (perforations), TD 11,557 ft. (New field—Forty Mile Bend).

Santa Rosa County: I. P. and Fred LaRue 1 Elliott, NE SW SW 25-3n-27w. Dry. TD 6,652 ft. Elev. 114 ft., Lower Cretaceous 6,539 ft.

ALABAMA

Escambia County: Sunnyland Contracting Co. 3 Atkinson, C NW NW 31- 2n-13e. Dry. TD 5,716 ft. Elev. 251 ft., Lower Cretaceous 5,500 ft.

Franklin County: J. L. Duffy and Jack Herrington 1 Bedford, C NE NW 26-8s-14w. Shut-in gas well, no gage, Mississippian 1,335-45 ft. TD 1,347 ft.

WILDCAT COMPLETIONS

MISSISSIPPI

Adams County: Jett Drilling Co. and H. W. Elliott 1 Boger, 44-6n-2w. Dry. TD 6,631 ft. Elev. 404 ft., Wilcox 4,491 ft., base Baker shale 6,307 ft., Minter zone 6,599 ft.

Petersen Drilling Co. et al 1 U.S.A., 34-5n-1w. Dry. TD 7,224 ft.

SOUTH LOUISIANA

Cameron Parish: Stanolind Oil & Gas Co. 1 State Lease 2263, Tract 5261, Calcasieu Lake. Dry. TD 13,586 ft.

Iberville Parish: F. A. Callery, Inc., 1 Jumonville, 91-10s-13e. IP 5,000 M.c.f. daily, open-flow potential, perforated 10,687-97 ft. TD 10,817 ft. (Extends Laurel Ridge field.)

Jefferson Parish: Monterrey Exploration Co. 1 New Orleans Plantation, 10-15s-23e. Dry. TD 10,806 ft.

Plaquemines Parish: Kerr-McGee Oil Industries, Inc., 1-F State Lease 1237, Tract 45, Breton Sound. IP 3,260 M.c.f., 20/64-in. choke, perforations 3,841-46 ft., and 2,430 M.c.f. daily, 16/64-in., perforations 4,127-33 ft. (dual completion). TD 7,870 ft. (New field.)

St. Charles Parish: F. A. Callery, Inc., 1-A Delta, 29-15s-21e (Camardelle prospect). Dry. TD 14,525 ft.

St. Landry Parish: Sinclair Oil & Gas Co. et al 2 Brewer-Neinstadt, 21-4s-6e. Dry. TD 10,495 ft.

St. Mary Parish: Cities Service Oil Co. 1 Homer Gonsoulin, 68-13s-8e. Dry. TD 12,519 ft.

Magnolia Petroleum Co. 2-F State Lease 691, Blk. 119, Eugene Island area. IP 493 BOPD, 13/64-in., 37.6°, perforations 6,496-6,500 ft. TD 10,664 ft. (New pay Eugene Island Blk. 126 field.)

Vermilion Parish: Union Oil Co. of California 2 Louisiana Furs-Parish School Board, 16-15s-1w. IP 88 BOPD, 12/64-in., 37°, perforations 3,698-3,706 ft. TD 12,062 ft. (New pay in White Lake field.)

ARKANSAS

Nevada County: The Texas Co. 1 Foster et al, C SW NW 15-14s-23w. Dry. TD 6,072 ft.

White County: Irene Oil & Gas Corp. 2 Self estate, near SEc 29-6n-5w. Dry. TD 237 ft.

OKLAHOMA

Alfalfa County: L. J. Horwitz 1 Kephart, NW NW SE 29-25n-11w. Dry. TD 7,080 ft.

Cleveland County: Schafer Drilling Co. and Bond Oil Co. 1 Dees, C SE SE 26-6n-1e. Dry. TD 7,162 ft.

Comanche County: Garr-Wooley 1 Ryan, NE SE NW 3-2n-10w. IPP 12 BOPD, 1,492-1,578 ft., 38°, TD 2,335 ft. (Oil discovery.)

Creek County: Kirschner Bros. 1-A Bunting, SE SW NW NW 3-16n-10e. IPP 300 BOPD, Red Fork 2,074-98 ft., 35°. TD 2,110 ft. (Oil discovery.)

Jefferson County: Paul Hammer 1 Byram, SW NE SE 26-3s-4w. Dry. TD 1,242 ft.

J. A. Maurer 1 McGinnis, NW NE SE 31-7s-6w. Dry. TD 5,949 ft.

Logan County: Fleet Drilling Co. 1 Bridal, NW SE NE 7-17n-3w. Dry. TD 6,465 ft.

McClain County: Harper-Turner Oil Co. 1 Hall, C SW SW 20-5n-1w. Dry. TD 7,873 ft.

Okfuskee County: Davon 1 McCormick, SE SE NE 29-12n-8e. Dry. TD 3,706 ft.

Osage County: R. Dillard 1 Osage, SE SE NE 10-23n-7e. Dry. TD 2,682 ft.

Payne County: Percy Butler 1 Robinson, SE SE NE 31-20n-4e. Dry. TD 4,349 ft.

Pawnee County: Wilcox Oil Co. and Sunray Oil Corp. 1 Gatewood, NE NE SE 35-22n-3e. Dry. TD 4,319 ft.

Roger Mills County: Altus Drilling Co. and A. J. Hammer 1 Fowler, C NE SE 7-12n-22w. Dry. TD 7,248 ft.

Seminole County: J. P. Booth 1 Okey, SW SE NW 22-9n-8e. Dry. TD 3,565 ft.

Stephens County: Mack Oil Co. 1 Ketchum, NE NE NW 7-1s-5w. Dry. TD 3,013 ft.

Tillman County: K.L.B. Drilling Corp. 1 Harvey, NE NE NE SW 29-3s-14w. Dry. TD 1,700 ft.

Washita County: Huffman & Malloy 1 Grab, SE SE NW 35-8n-17w. IPF 17.5 BOPD, 3,500 M.c.f. of gas per day, porosity zone 6,705-91 ft., 63.8°, 15/64-in. TD 7,331 ft. (Gas-distillate discovery.)

KANSAS

Barton County: Helmerich & Payne 1 Button, SW SW NW 23-19s-15w. Dry. TD 3,616 ft.

El Dorado Refining Co. 1 Cagleman, NE NE NW 25-19s-15w. Dry. TD 3,587 ft.

Decatur County: W. G. Hills 1 Scott, SE SE NW 33-2s-29w. Dry. TD 4,268 ft.

Hodgeman County: M. B. Armer 2 Smalley "A," C S½ SE NE 9-23s-24w. Dry. TD 4,630 ft.

Kingman County: Pickrell Drilling Co. 1 Banta, SW SW SW 34-30s-8w. Dry. TD 4,942 ft.

Pawnee County: Amer Drilling Co. 1 Peter, SW SW NE 28-22s-16w. Dry. TD 4,170 ft.

Rawlins County B. R. G. Oil Co. 1 Hamilton, SW SW NE 17-5s-31w. Dry. TD 4,655 ft.

Rice County: Dozier Oil Co. 1 Shonyo, NE NE NE 11-18s-10w. Dry. TD 3,331 ft.

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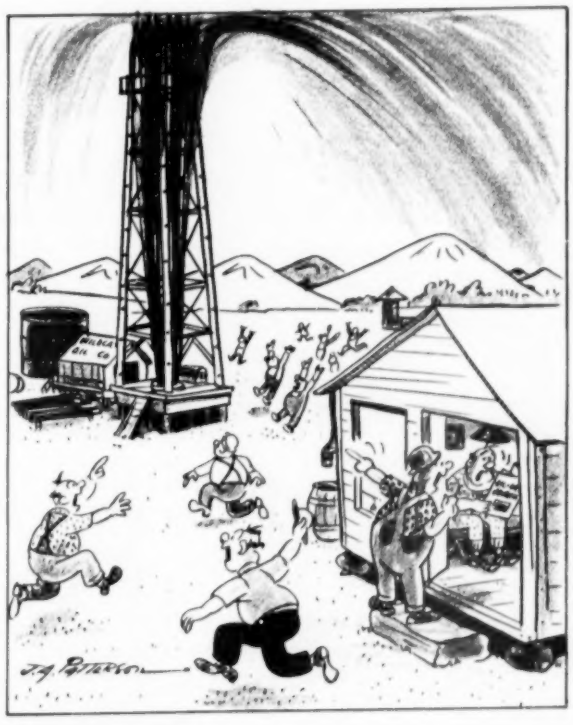

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WILDCAT COMPLETIONS

NORTH DAKOTA

Bottineau County: Calvert Exploration 1 Christensen, NE SW 27-163n-75w. Dry. TD 3,510 ft. Piper 3,947 ft.

Dickey County: Hermon Hanson Oil Syndicate 1 Harold Billey, C SE NW 11-129n-63w. Temporarily abandoned. TD 1,882 ft. Pre-Cambrian 1,880 ft.

CALIFORNIA

Glenn County: R. S. Rheem, Opr. 1-20 Zumwalt, 20-18n-1w. Dry. TD 5,578 ft.

Kern County: Ferguson & Bosworth 1 U. S.-Westpet, 30-29s-21e. Dry. TD 4,295 ft.

Jet Petroleum Co. 2 Jetco, 26-29s-20e. Dry. TD 420 ft.

Richfield Oil Corp. 1 Moore, 32-11n-24w. Dry. TD 7,037 ft.

C. R. Robinson 42 Ripley, 25-11n-23w. Dry. TD 930 ft.

Standard Oil Co. of California 78-35 K.C.L.-34, 35-28s-26e. Dry. TD 4,925 ft.

Standard Oil Co. of California 12-6 K.C.L.-35, 6-29s-27e. Dry. TD 4,090 ft.

The Texas Co. 1 Coulter, 25-30s-26e. Dry. TD 8,314 ft.

Universal Consolidated Oil Co. 1 Oliver, 8-30s-29e. Dry. TD 6,150 ft.

Kings County: Caminol Co. 1 Dagany, SW NE 33-24s-18e, IPP BOPD, 16° gravity, Perfs. 803-855 ft. in second Kreyenhagen (Eocene) sand, TD 4,890 ft., PB 890 ft. (New pool discovery in Orchard area of Pyramid Hills field).

Reserve Oil & Gas Co. 38-20 Reserve-Orchard, 20-24s-18e. Dry. TD 1,250 ft.

Los Angeles County: Atlantic Oil Co. 1 Nettleship, 30-1n-16w. Dry. TD 3,590 ft.

Orange County: The Texas Co. 1 Ragan, 15-4s-9w. Dry. TD 5,690 ft.

San Benito County: Oceanic Oil Co. 1 Maggini, 10-18s-9e. Dry. TD 4,967 ft.

Ventura County: Standard Oil Co. of California 1 Scholle-Livingston, 32-2n-21w. Dry. TD 9,433 ft.

Terry Drilling Co. 2 Paula, NE NW 22-4n-21w, IPP 280 BPD, 10 per cent cut, 26° gravity, Perfs. 1,610-2,394 ft., OWDD 222 ft., TD 2,491 ft. (New pool in Santa Paula Creek area.)

MANITOBA

J. P. Owen-Poole 14-5 Manson, LSD 14, 5-14-29w1. Dry. TD 2,398 ft.

SASKATCHEWAN

Socony-Sohio 1 West Marquis, LSD 12, 28-19-28w2. Dry. TD 3,809 ft.

Smiley-Alminex 6-27 Crystal, LSD 6, 27-30-27w3. Dry. TD 2,963 ft.

Imperial 7-17V Dewar, LSD 7, 17-31-26w3. Dry. TD 2,500 ft.

Sturgeon & Associates 2 Smiley, LSD 2, 35-30-27w3. Dry. TD 2,523 ft.

ALBERTA

Banff-Brinkerholff-Seaboard 2-7 Bittern Lake, LSD 2, 7-47-21w4. Dry. 5,523 ft.

Socony-Seaboard 30-10 Pembina, LSD 10, 30-8w5. Cardium oil well. TD 5,280 ft.

Baysel 13-21 Picture Butte, LSD 13, 21-10-21w4. Dry. TD 5,996 ft.

NEBRASKA

Kimball County: Shell Oil 1 Blodgett, NW NW NE 17-12n-55w. Dry. TD 6,465 ft. Dakota 6,356 ft.

MONTANA

McCone County, W. Richey: R. V. & T. F. Hodge 1 Eggebrecht, C SW SE 3-23n-49e. IPF 180 BO and 1,052 BWPD, 5/8-in. choke, Silurian discovery—new field. Red River 9,694 ft. TD 10,005 ft.

Prairie County, Whitney: Phillips Petroleum-Amerada Petroleum-No. Pacific R. R. 1 NPRR, C NW NE 33-12n-53e. Dry. TD 10,263 ft. Cambrian 10,250 ft. (?).

Rosebud County, N. W. Sumatra area: McAlester Fuel 1 Semingson, NE NE SE 13-11n-31e. Dry. TD 4,834 ft. Heath 4,714 ft.

WYOMING

Natrona County, Lane Creek: Argo Oil Corp. 2 State, NE NE SE 36-41n-80w. Dry. TD 2,379 ft. 2nd Wall Creek 2,283 ft.

Park County, S. E. Frost Ridge: Richfield Oil 1 Government-Walton, C NE SE 14-50n-101w. Dry. TD 6,871 ft. Morrison 6,665 ft.

Weston County, Clareton area: Monarch Drilling 1 Townsend, SW SW NW 24-43n-66w. Dry. TD 6,767 ft. Newcastle 6,610 ft.

COLORADO

Logan County, Minto: Sunray Oil Corp. 1 Knudson, NW NE NW 6-8n-52w. IPF 207 BOPD, ¼-in. choke, "J" sand discovery—new field. "J" sand 4,797 ft. TD 4,951 ft.

Derby Oil Co. and George & Downing 1 R. L. Norcott, C NW NE 1-10n-55w. Dry. TD 5,560 ft. Skull Creek 5,502 ft.

Morgan County: Carmack & Crawford 1 Porter, NE NE NE 15-2n-57w. Dry. TD 5,700 ft. "J" sand 5,546 ft.

Anderson-Prichard 1 Blanchard, C SE NE 11-6n-55w. Dry. TD 8,195 ft. Granite 8,186 ft.

Weld County: The California Co. 1 Winder, C SW NE 4-6n-67w. Dry. TD 9,657 ft. Engleside 9,198 ft.

EQUIPMENT MEN

LeTourneau-Westinghouse Names New Sales Executives

W. E. Hendricks, who has served as assistant to the general sales manager for LeTourneau-Westinghouse Co. since

HENDRICKS

LLOYD RAGER

last June, has been named domestic sales manager, company officials announce. Also announced by LeTourneau-Westinghouse is the appointment of Lloyd Rager as sales promotion manager.

In his new position, Hendricks succeeds H. R. Powers, who has resigned. When he joined LeTourneau-Westinghouse, Hendricks was in charge of government sales. Formerly, he served as sales manager for a LeTourneau-Westinghouse distributor in Pittsburgh, A. T. Green Machinery Co. Previously, he spent 11½ years with LaPlant-Choate Manufacturing Co. Starting as a service engineer with that company, he advanced through the sales department to become district representative. In 1949, he was named assistant sales manager in charge of the field sales force.

Assistant advertising manager for the past 4 years, Rager has been with LeTourneau 17 years. In his new position he will provide promotional and merchandising help to the LeTourneau-Westinghouse distributor organization. This will include obtaining market data and planning of product promotion programs.

Baker Made Ansul Promotion And Advertising Manager

Ansul Chemical Co. has announced the appointment of Richard M. Baker as advertising and sales promotion manager. Baker, who has been with the company 6 years as publicity manager, is a graduate of Northwestern University.

Ansul also named Brad Sebstad as publicity and publications manager. Sebstad is a graduate of University of Wisconsin's school of journalism.

Nicholson Buys Halpine Interest in Tank Service

NICHOLSON

J. C. Nicholson, formerly vice president of Natasco Co., has announced his purchase of the interest of J. A. Halpine in Tank Service, Inc., of Tulsa. Halpine will continue in an advisory position with the company.

In an expansion program, the company has erected its own building on North Lewis, where both office and shop facilities are available, according to Nicholson. C. E. Spencer, the other partner in the firm, has been with the company since its inception.

The company will specialize in tank engineering, fabrication of tank fittings, repair and modification of tanks, and the application of coatings.

(Continued on page 154)

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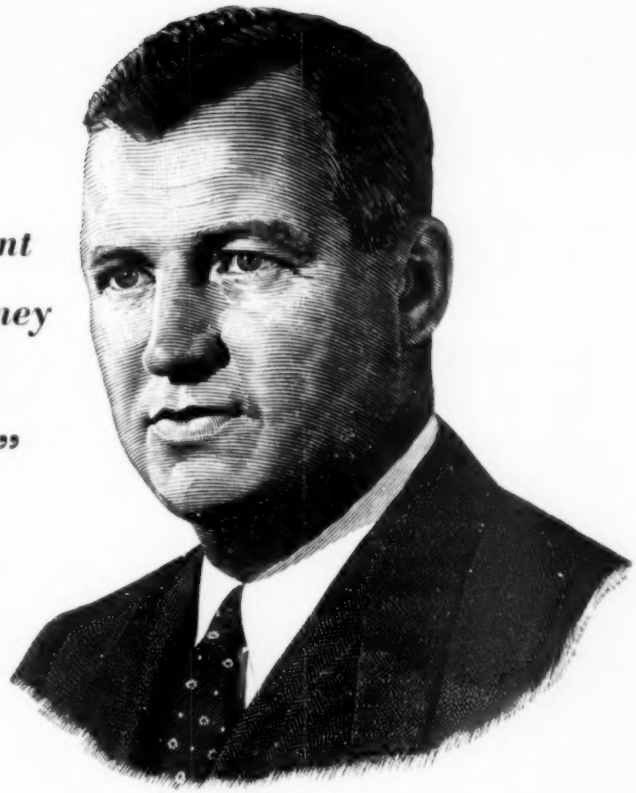

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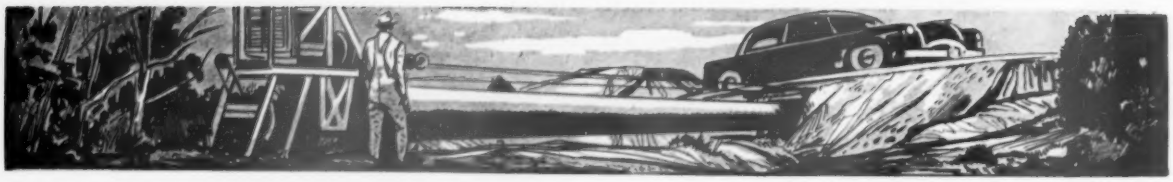

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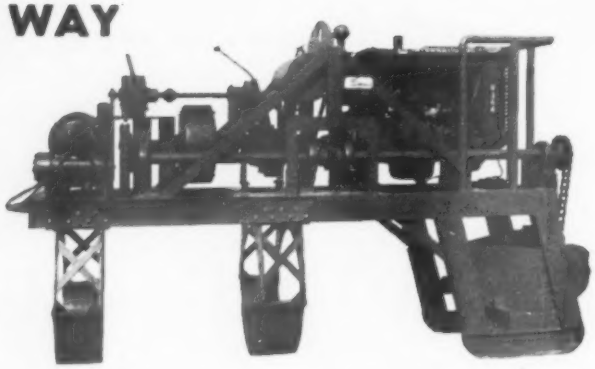

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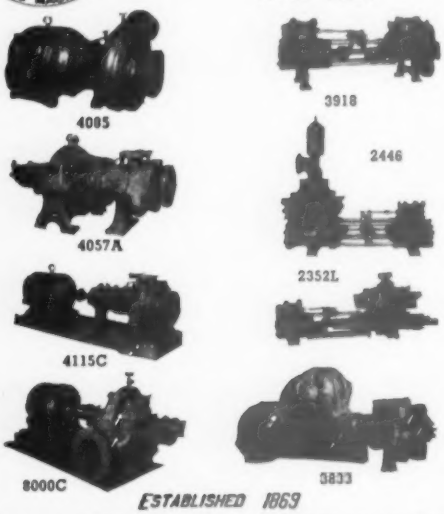

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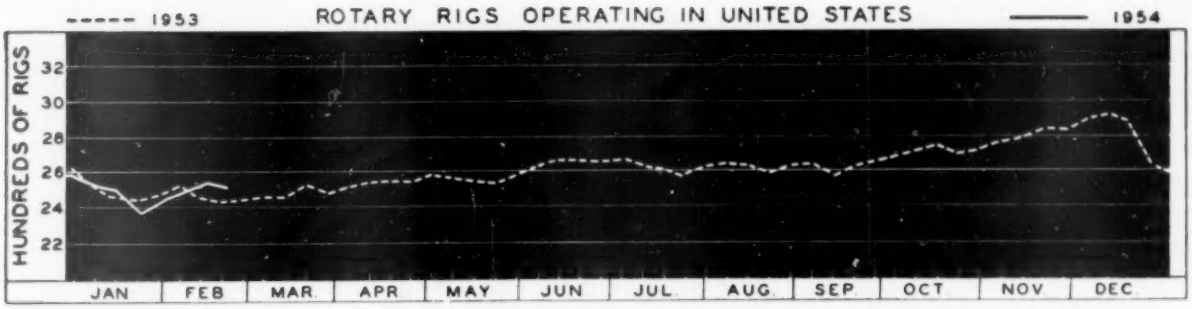
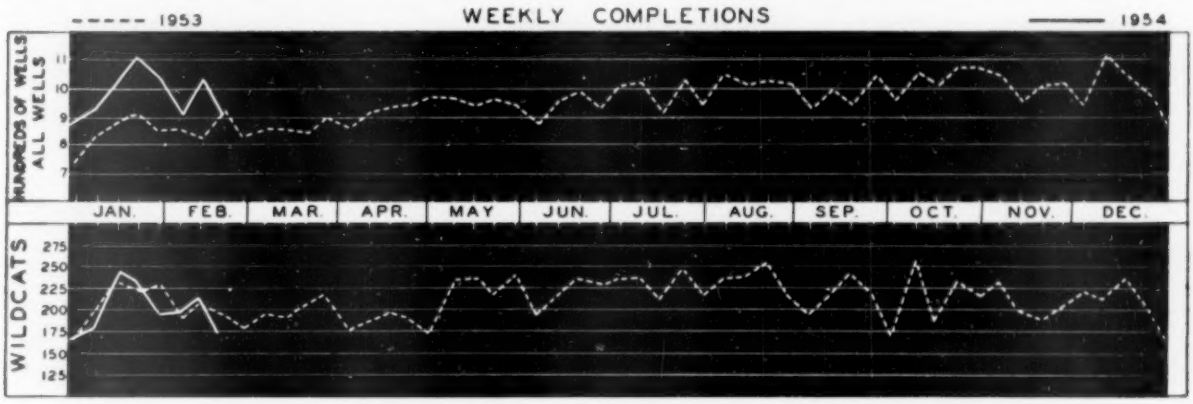




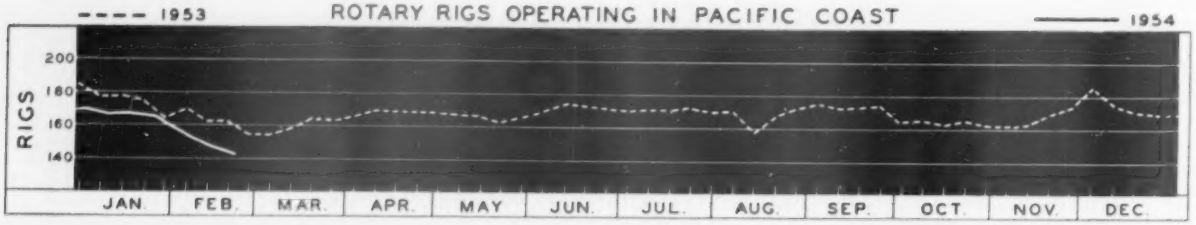
CURRENT STATISTICS

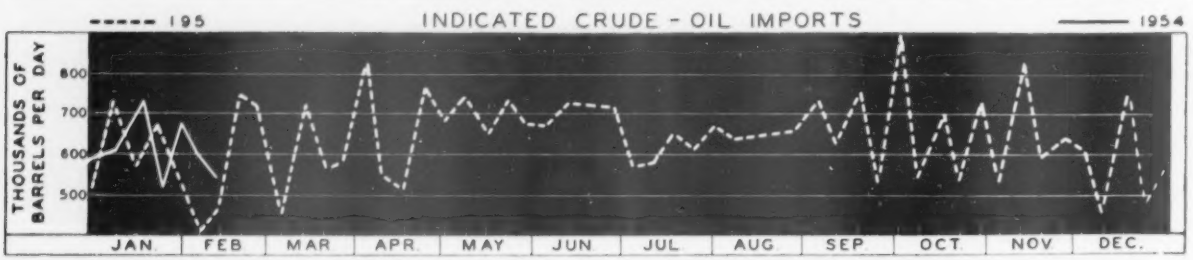
EXPLORATION

WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 20, 1954

	Total of all wells					Feb. 20		Wildcat completions and discoveries					Cumulative total, 1954				
	Comp.	Oil	Gas	Dry	Footage	1954	1953	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Pennsylvania-New York	40	18	3	*19	56,502	345	320	0	0	0	0	0	0	0	1	6	7
West Virginia	13	4	6	3	37,130	75	79	0	0	0	0	0	0	0	3	3	6
Ohio	19	14	1	†4	41,044	128	134	0	0	0	0	0	0	0	2	1	3
Indiana	8	3	0	5	11,459	96	186	0	0	0	0	0	0	0	0	19	19
Kentucky	21	11	7	3	48,223	151	150	0	0	0	0	0	1	0	0	16	17
Illinois	39	24	0	15	100,188	379	276	0	0	0	3	3	0	0	0	68	68
Michigan	8	5	0	3	21,872	96	85	0	0	0	2	2	0	0	0	43	43
Kansas	71	36	4	†31	237,932	611	628	0	0	0	8	8	6	0	2	79	87
Nebraska	5	1	0	4	30,192	52	41	0	0	0	1	1	4	0	0	14	18
Oklahoma	163	95	6	‡62	528,311	1,375	910	2	0	1	14	17	18	2	3	101	124
Texas	293	163	24	106	1,438,655	2,503	2,223	8	1	3	78	90	114	13	23	613	763
North Central (Dist. 7-B & 9)	89	49	0	40	289,842	885	777	3	0	0	28	31	64	0	1	236	301
West (Dist. 7-C & 8)	82	58	2	22	486,291	591	497	2	0	1	17	20	27	0	2	118	147
Panhandle (Dist. 10)	19	9	7	3	59,695	134	114	0	0	0	1	1	0	0	2	11	13
Eastern (Dist. 5 & 6)	7	2	2	3	33,601	93	99	0	0	1	2	3	2	0	3	25	30
Gulf Coast (Dist. 2 & 3)	54	24	7	23	366,663	425	347	1	1	0	15	17	10	6	7	107	130
Southwest (Dist. 1 & 4)	42	21	6	15	202,563	375	389	2	0	1	15	18	11	7	8	116	142
Louisiana	59	35	6	18	409,701	508	380	2	0	2	5	9	13	7	5	42	67
Northern	27	20	2	5	71,818	275	163	0	0	0	0	0	2	0	0	11	13
Southern	32	15	4	13	337,883	233	217	2	0	2	5	9	11	7	5	31	54
Arkansas	14	10	0	4	50,975	105	60	0	0	0	2	2	4	0	0	14	18
Mississippi	5	1	0	4	34,021	47	62	0	0	0	2	2	2	0	0	16	18
Southeastern States	4	1	1	2	25,272	19	21	1	0	1	2	4	1	0	1	14	16
Montana	8	5	0	3	33,411	43	51	1	0	0	2	3	1	0	0	12	13
Wyoming	44	26	1	17	210,571	239	82	0	0	0	3	3	7	0	1	30	38
Colorado	16	9	2	5	92,314	144	77	1	0	0	4	5	4	0	0	60	64
Utah	0	0	0	0	0	8	11	0	0	0	0	0	0	0	0	3	3
New Mexico	26	7	10	9	156,375	197	171	0	0	0	7	7	1	0	1	25	27
California	53	37	1	15	280,691	348	330	2	0	0	14	16	12	0	3	71	86
North Dakota	3	1	0	2	18,198	32	37	0	0	0	2	2	1	0	0	8	9
Miscellaneous	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	6	6
Total United States	912	506	72	334	3,863,037	7,507	6,320	17	1	7	149	174	189	22	45	1,264	1,520
Total previous week	1,039	585	56	398	4,208,803			21	5	1	188	215	172	21	38	1,115	1,346
Total February 21, 1953	936	479	77	380	3,831,261			25	0	4	168	197	205	18	44	1,277	1,544

Service wells included: *17, †2, ‡10.

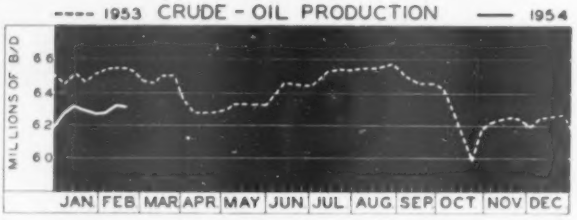


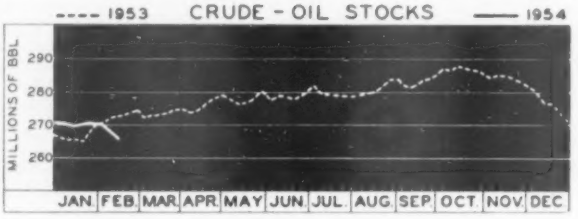


DAILY AVERAGE PRODUCTION FOR WEEK

	February 20			Feb. 13
	Crude oil	Lease condensate	Total	total
Alabama	4,300		4,300	4,400
Arkansas	75,000	500	75,500	76,000
California	1,003,300		1,003,300	1,004,200
Colorado	113,600		113,600	113,900
Eastern	58,200		58,200	58,300
Florida	1,450		1,450	1,450
Illinois	175,500		175,500	172,800
Indiana	31,000		31,000	31,600
Kansas	329,300		329,300	338,300
Kentucky	33,700		33,700	33,500
Louisiana	625,750	46,650	672,400	672,550
North	105,750	3,650	109,400	109,550
South	520,000	43,000	563,000	563,000
Michigan	33,400		33,400	33,200
Mississippi	88,700	3,850	92,550	92,700
Montana	35,400		35,400	35,700
Nebraska	18,700		18,700	18,600
New Mexico	203,900	1,675	205,575	205,575
Oklahoma	520,300		520,300	522,600
Texas	2,612,400	53,000	2,665,400	2,665,400
Dist. 1	39,900	575	40,475	40,475
Dist. 2	134,800	7,800	142,600	142,600
Dist. 3	414,000	25,000	439,000	439,000
Dist. 4	239,500	6,300	245,800	245,800
Dist. 5	38,200	450	38,650	38,650
Dist. 6	108,500	5,700	114,200	114,200
East Texas field	227,000		227,000	227,000
Dist. 7-B	125,000	75	125,075	125,075
Dist. 7-C	175,000	4,850	179,850	179,850
Dist. 8	845,000	1,700	846,700	846,700
Dist. 9	185,000	500	185,500	185,500
Dist. 10	80,500	50	80,550	80,550
Utah	4,300		4,300	4,500
Wyoming	232,100		232,100	237,200
North Dakota	14,400		14,400	14,200
Total U. S.	6,214,700	105,675	6,320,375	6,336,675
Change from previous week, down			16,300	
Canada	262,750		262,750	233,775
Total U. S. production January 1-February 20			321,303,350 bbl.	
Same period last year (crude plus cond.)			*334,534,000 bbl.	

*Includes 4,642,675 bbl. condensate.



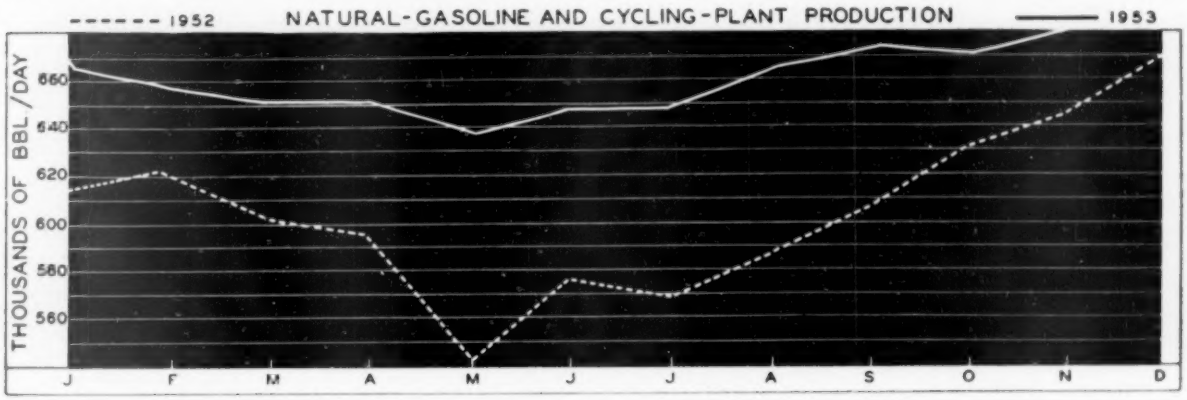


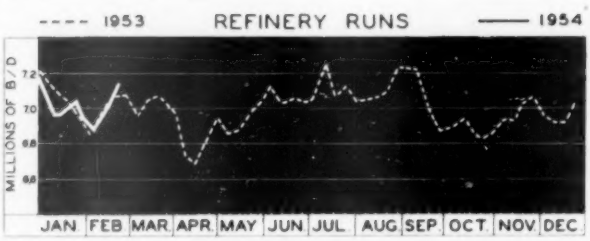
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

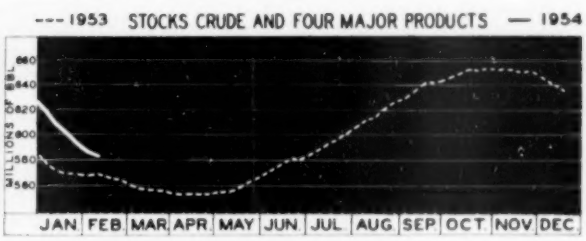
(Thousands of barrels)

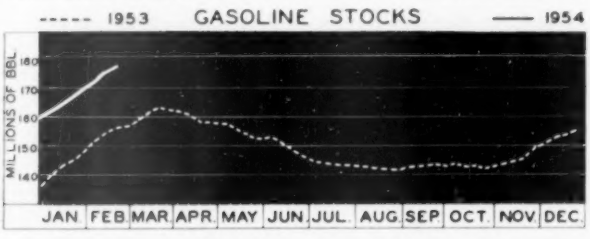
	Feb. 13, '54	Feb. 6, '54	Feb. 14, '53
Pennsylvania Grade	2,576	2,629	2,218
Other Appalachian	1,609	1,611	2,289
Illinois, Indiana, Michigan	11,604	12,452	10,151
Arkansas	3,280	3,328	2,917
Louisiana	14,932	14,947	16,257
North	2,634	2,626	2,430
Gulf	12,298	12,321	13,827
Mississippi	3,370	3,447	3,425
New Mexico	8,131	8,319	7,758
Oklahoma and Kansas	36,895	36,868	36,891
Texas	123,844	123,451	134,644
East Texas	11,122	11,319	11,040
West Texas	53,143	52,870	64,477
Texas Gulf	25,871	25,761	25,679
Other Texas	33,708	33,501	33,448
Rocky Mountain	16,455	16,708	15,681
California	33,218	33,394	32,872
Foreign	†10,189	10,742	6,783
Total	266,103	267,896	271,886

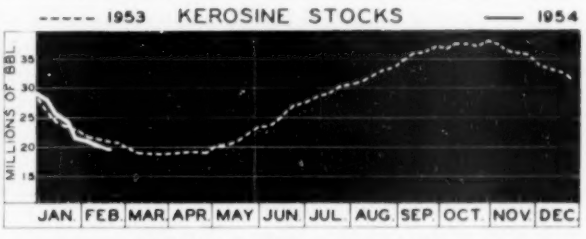
*Bureau of Mines. †Includes 2,937,000 bbl. in California.

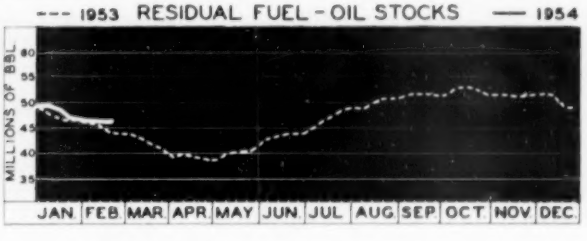










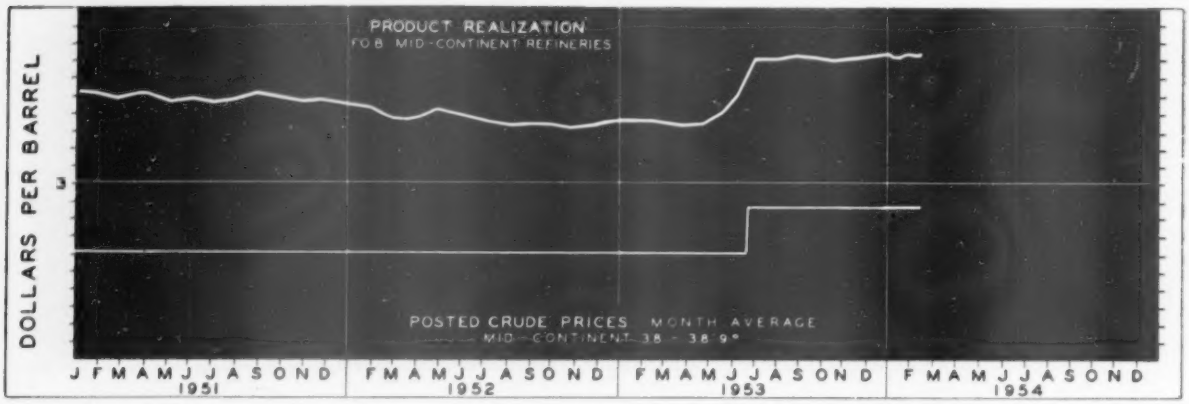


A.P.I. REFINERY REPORT, FEBRUARY 20

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1953 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,013	415.4	50.1	269.9	223.6	34,604	8,007	24,786	9,161	973	383.9	41.5	252.4	245.5
Appalachian:														
District 1	121	50.0	9.8	30.9	14.0	4,507	436	1,122	681	109	45.1	4.7	19.3	15.0
District 2	92	49.4	7.7	19.4	16.3	1,995	448	494	216	82	39.1	5.1	14.0	20.2
Ind., Ill., Ky.	1,339	720.1	86.3	258.6	184.3	38,756	4,697	11,157	4,278	1,252	664.9	84.4	232.8	196.9
Okla., Kans., Mo.	597	347.7	13.6	156.7	45.0	19,188	1,050	7,004	1,100	556	310.6	13.6	134.5	68.4
Inland Texas	264	196.1	11.7	35.0	25.6	7,280	224	1,120	1,204	251	176.1	15.2	40.2	41.2
Texas Gulf Coast	1,746	808.1	167.3	433.4	233.0	26,085	2,096	6,408	5,785	1,645	740.0	137.9	421.3	255.8
La. Gulf Coast	612	291.0	85.6	145.4	53.7	10,713	1,271	3,251	1,173	530	214.6	49.0	154.8	60.3
N. La. and Ark.	88	37.0	7.6	23.4	6.4	3,655	675	967	118	79	35.5	7.2	20.4	6.8
Rocky Mountain:														
New Mexico	19	12.4		2.9	2.7	204		34	28	17	10.6	0.5	2.5	3.9
Other Rocky Mtn.	240	122.9	3.6	50.9	43.8	7,617	174	1,988	797	217	99.2	6.9	48.8	47.7
California	1,025	461.9	2.4	142.4	376.3	22,760	343	11,397	21,674	962	389.5	4.4	187.1	360.8
Feb. 20, 1954	7,156	3,512.1	445.7	1,568.9	1,224.7	177,364	19,421	69,728	46,215	6,673	3,109.1	370.4	1,528.1	1,322.5
Feb. 13, 1954	7,030	3,488.7	406.1	1,526.1	1,214.1	175,908	20,041	73,754	45,921					
Feb. 21, 1953	7,079	3,446.1	437.9	1,553.0	1,301.9	156,063	21,357	71,506	44,364					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
3
POSTED CRUDE PRICES MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1951
F M A M J J A S O N D
1952
F M A M J J A S O N D
1953
F M A M J J A S O N D
1954

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.76 for week ended February 13, $3.75 for previous week, and $3.37 for February 1953. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of February 24, 1954. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.75-11	11.75-12.50	10.25-10.50
Premium gasoline	11.75-12	13.25-14	11.75-12.25
42-44 w.w. kerosine	9.125-9.375	10.65-10.9	9.5-9.75
No. 2 straw fuel oil	8.25-8.375	9.65-9.9	8.5-8.75
No. 6 residual	$1.35-1.50	$2.25-2.40	$1.85-1.95

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.0	4.5	4.75
Grade 18-55	6.0	5.5	5.75

LUBRICATING OILS
South Texas

200 vis., No. 2-3 neutral	12.5
750 vis., No. 3-4 neutral	15.5
2,000 vis., 5-6 neutral	17

LUBRICATING OILS
Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	19
200 vis., No. 3 neutral, 0-10 pp.	14.25

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	19.5
180 vis., 10 p.t. neutral	22.5

WAX
Mid-Continent

132-134 A.M.P.	6.0

RESIDUAL fuel is readily available in the Mid-Continent at prices well under the quotations for the period of cold weather in January.

The market for heavy fuel in the Group 3 and North Central areas strengthened abnormally during the summer months of 1953, following a period of soft markets during the winter months when residual demand should have been at a peak. The Group 3 low for residual did not reach $1.00 a barrel until near the end of June, but the upward trend continued for the remaining months of 1953 and through most of January.

There were rumors last summer that heavy fuel on the Group 3 market probably would go to $1.50 a barrel during the winter months. The Group 3 low did reach $1.50 about the first of the year. During the period of cold weather in January, the market was firm at this level, but the drop in demand over the past 4 weeks has indicated that residual at $1.50 a barrel does not compete with some other fuels except in periods of high demand.

Some refiners are taking another look at the residual price structure on the Group 3 market in an attempt to determine if the price level of $1.50 was based on a competitive boiler-fuel market or if refiners with coking units had figured that residual was worth about that much as source material for cracking stock.

Excessive gasoline inventories and the slight drop in demand for distillate fuels have tended to reduce the need for extra cracking stock during the spring months. This change left some extra residual to be absorbed by the fuel market and the price had to be dropped to expand the market enough to cover the extra material. However, the high potential demand for gasoline will insure enough coking to prevent a real break in the residual market. Gasoline markets are still soft.

CRUDE PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.*	Okla-homa, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87	....	....	....
15-15.9	1.93	....	....	....
16-16.9	1.99	....	....	....
17-17.9	2.05	....	....	....
18-18.9	2.11	....	....	....
19-19.9	2.18	....	....	....
20-20.9	2.24	$2.50	....	$2.37
21-21.9	2.30	2.52	....	2.39
22-22.9	2.37	2.54	....	2.41
23-23.9	2.45	2.56	....	2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9	....	2.76	3.09	2.63
34-34.9	....	2.78	3.11	2.65
35-35.9	....	2.80	3.13	2.67
36-36.9	....	2.82	3.15	2.69
37-37.9	....	2.84	3.17	2.71
38-38.9	....	2.86	3.19	2.73
39-39.9	....	2.88	3.21	2.75
40 and above	....	2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast ‡Includes New Mexico Permian.

Prices East of California effective June 15, 1953. California prices effective February 16, 1953. Pennsylvania Grade prices effective January 1, 1954.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.76
Middle District	3.70
Southwest Pennsylvania	3.31
West Virginia	3.25
Ohio	3.24
Illinois Basin	3.02

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HELP WANTED

OIL INDUSTRY Employment Service, Tom Robinson, owner, 405 Tuloma Bldg., Tulsa, Oklahoma. For technical and trained oil industry personnel. Write for blank.

SUPPLY - SPECIALTY Field Salesman, slushpump liners, rig parts. Prefer married GI now residing Illinois-Tristate area. Previous roughneck experience helpful. Must be dependable, bondable, healthy and hard worker. No lushes need apply. Drawing account, transportation, expenses furnished. Young concern, growing fast. Box G-967, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM OR

RESERVOIR ENGINEER

For New York office of major foreign producer. Proficient in mathematics with 4 or more years' extensive experience in oil and gas reservoir engineering on primary and secondary recovery problems. Duties will include preparations of basic field production and reservoir data for application in analogue and digital computors, performance of analytical analysis of field behavior and interpretation and preparation of resulting data for reservoir engineering reports on specific fields.

Write giving full particulars regarding personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR
BOX OG-1
Arabian American Oil Company
505 Park Avenue
New York 22, N. Y.

HELP WANTED

INSTRUMENT ENGINEER
Expanding instrument manufacturer has opening for instrument engineer with at least seven years experience, preferably in manufacturing and assembly of industrial instruments. For the right man this job could lead to managerial position. Must be aggressive, capable supervisor, and willing to assume responsibility. Age 30-40. Salary open. Apply to Industrial Instrument Corporation, P. O. Box 1909, Odessa, Texas.

CHIEF CHEMIST experienced in Pod column work and gasoline plant process and product control testing to take charge of laboratory located at large gasoline plant in West Texas. Housing furnished and salary to be commensurate with qualifications of applicant. Please furnish experience record and salary expected. Our employees have been notified of this advertisement. Box G-776, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED OPERATORS & MAINTENANCE MEN for new small refinery being completed March 1954. Texas MEK deoiling process. Send statement of qualifications to P.O. Box 863, Salt Lake City, Utah.

GEOLOGIST
With at least five years subsurface experience in Oklahoma for responsible position with active oil producing company in Tulsa. Excellent opportunity for advancement in compact organization. Write full particulars of education and experience to Box G-961, The Oil and Gas Journal, Tulsa, Oklahoma.

COLLEGE GRADUATE to work in Geophysical Dept. Degree in Geology, or Geological or Petroleum Engineering required. Mathematics through calculus and basic physics courses required also. No experience necessary. For further information contact Personnel Dept. The Superior Oil Company, Midland, Texas.

INDUSTRIAL SALES REPRESENTATIVE
Integrated oil company has excellent opportunity for qualified applicant. Position requires experience and knowledge of manufacture and sale of all industrial petroleum products including Naphthas and Solvents. Constant travel in the following states required: Illinois, Indiana, Southern Michigan, Western Ohio, and Northeast Missouri. All replies should contain work history, salary required, and recent photograph. Box G-960, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

PHOTOGEOLOGIST—To head photogeolic interpretation section. Must be College graduate—5 years experience—mining experience desirable. Write giving age, education, and full details of experience. All replies confidential. Box G-968, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Sales Personnel for expanding oil well equipment company. College graduates, age 25-35. Salaries about $500.00 plus bonus and benefits. Send qualifications summary to Box G-934, The Oil and Gas Journal, Tulsa, Oklahoma.

Micropaleontologist

Preferably with an advanced degree and a minimum of 5 years' commercial or academic experience. To work in the New York research laboratory of a major oil company. This position demands broad interests in Stratigraphy and Biofacies and the capacity to do independent work on projects assigned. Salary dependent on experience and qualifications.

Write giving personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR
BOX OGJ
Arabian - American Oil Company
505 Park Avenue
New York 22, N. Y.

PROCESS SUPERINTENDENT
MAINTENANCE SUPERINTENDENT
TECHNICAL DIRECTOR

NEW REFINERY IN UPPER MISSISSIPPI RIVER AREA

Resourceful young men wanted with at least seven (7) years petroleum refinery experience including some supervisory experience. College degree or equivalent. Must have knowledge of petroleum distillation, catalytic cracking, catalytic polymerization, catalytic reforming, desulphurization and coking.

Salary commensurate with ability and experience. In reply please submit resume of additional background and experience. All replies confidential.

Box G-944, The Oil and Gas Journal, Tulsa, Oklahoma

EXPLORATION MANAGER
Must have 5 years' Executive Geological Background and extensive Lease Trading experience.
SALARY: to $20,000
This position is with a well established Independent Oil Company.
CHAS. J. LOVELESS, Personal Service
616 S. Main Tulsa, Oklahoma

HELP WANTED

REFINERY PLANT MANAGER

NEW REFINERY IN UPPER MISSISSIPPI RIVER AREA

A resourceful leader and planner under forty-five (45) with ten (10) years or more refinery experience including some time in supervisory capacity. Require man with degree in Chemistry, Chemical or Mechanical Engineering and should have knowledge of petroleum distillation, catalytic cracking, catalytic polymerization, catalytic reforming, desulphurization and coking. Must be familiar with quality and cost control methods and experienced in handling labor.

Salary commensurate with ability plus stock options in Company for right man. Please submit resume of additional background and experience. All replies confidential.

Box G-943, The Oil and Gas Journal, Tulsa, Oklahoma

GEOLOGIST
Independent oil company has opening around March 10, for combination geologist and landman. Must be experienced and thoroughly familiar with Julesburg Basin and have general knowledge of Rocky Mountains. Good position for right person. In applying, give past employment record, educational background, and age. All replies strictly confidential. Box G-956, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-LANDMAN
Independent oil company has opening around March 15, for combination geologist and landman. Must be capable and thoroughly familiar with West Texas and New Mexico. Good position for right person. In applying, give past employment record, educational background, and age. All replies strictly confidential. Box G-955, The Oil and Gas Journal, Tulsa, Oklahoma.

SALESMAN: Independent refinery desires product salesman preferably experience Oklahoma and North Texas. State complete experience record and salary desired. Box G-963, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES MANAGER for oil well equipment business, having engineering education, 10 to 15 years' experience in sales and supervisory capacities and having major oil company contacts. Age 35-45. Substantial salary and commission. Submit detailed resume of qualifications to Box G-910, The Oil and Gas Journal, Tulsa, Oklahoma.

THE POSITION YOU WANT: Oil industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

REFINERY PROCESS ENGINEER for independent midwest refinery. Young man with fluid catalytic experience. Excellent opportunity. State experience fully and salary desired. Replies confidential. Box G-962, The Oil and Gas Journal, Tulsa, Oklahoma.

PUBLIC UTILITY ENGINEER

Large, long established natural gas company in the West has an opening for an experienced senior staff engineer; one who under the management can plan and supervise the preparation of regulatory and rate matters, personally testify before commissions and assist the management in problems of utility operations. It is essential that the applicant understand gas distribution and transmission operations, have a comprehensive knowledge of public utility requirements and experience in processing matters before commissions or public bodies. Position is permanent and salary is open.

All replies will be confidential with the executive head of the company.

Box G-933
The Oil and Gas Journal
Tulsa, Oklahoma

HELP WANTED

WANTED: Graduate Petroleum Engineer with varied experience in completion and reservoir work by independent oil company. Give full particulars of experience and salary expected in first reply. Box G-969, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING EQUIPMENT ENGINEER

Capable of assuming responsibilities associated with equipment and materials procurement, detailing specifications, inspection, appraising commodities of new design, operational and maintenance problems. Substantial correspondence and limited design engineering required in performing duties. For New York office. Some foreign travel involved.

Write giving full particulars regarding personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR
BOX OGJ 5
Arabian American Oil Company
505 Park Avenue
New York 22, N. Y.

SITUATIONS WANTED

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. [illegible]8, Ph. No. 3-3141, Hobbs, New Mexico.

REFINERY PROCESS ENGINEER

Currently employed with major oil company operating in South America. Twelve years experience process control, design and economic studies large integrated refinery. B.S.-1941. Age 34. Desire return U.S.A. for permanent location. Box G-946, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

MECHANICAL ENGINEER—28. Single, now employed by major oil company. 3½ years field and office experience. Desires responsible position domestic or foreign. Complete resume upon request. Box G-930, The Oil and Gas Journal, Tulsa, Oklahoma.

B.S. IN Mechanical Engineering with Chemistry minor, age 39, family, sixteen years refinery experience, including operation supervision, process and design, and administrative duties, desires immediate connection with growing company. References available. Box G-964, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER, fifteen years' experience in the operation and design of Gasoline Plants, Refineries and Petro-Chemical Plants, specialized in the design and operation of high purity ethylene plants. Desires responsible position with a progressive Oil Company. Box G-791, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM SEISMOLOGIST: 5 years record work. Education in Physics and Geology. Box G-953, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED master mechanic for trucks, stationary engines, diesel motors. Capable of complete fleet supervision. 20 years experience, references. Family man, will relocate. Write W. C. Saylors, 628 So. Poplar, Sapulpa, Okla. Telephone 826.

PRODUCTION SUPERINTENDENT experienced in Texas, Oklahoma, Kansas and Illinois. Box G-970, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERING & SALES EXECUTIVE
Recognized authority on production practices with extensive experience in design and application of production and drilling equipment. Desires connection with manufacturer or substantial oil company. Box G-945, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN: Ten years experience all phases field and office functions land department production company. College and legal education. Relocate and travel. Box G-941, The Oil and Gas Journal, Tulsa, Oklahoma.

THE RIGHT MAN: Can you fill the position you have open from the qualifications listed in this column. Men are always looking for an opportunity to improve themselves. Use a "Help Wanted" Journal classified advertisement to find the men you need. See box heading for classified rates or write The Oil and Gas Journal

WANTED IN CANADA

EXPERIENCED MAUFACTURER REPRESENTATIVE IN CANADA DESIRES ADDITIONAL ACCOUNTS. MANUFACTURERS NOW REPRESENTED INCLUDE GRAY TOOL CO. AND VENTURA TOOL CO. BEST OF REFERENCES.

LEIDECKER TOOL CO. LTD.
6921 104TH STREET
EDMONTON, ALBERTA CANADA
PHONE 35016

EQUIPMENT FOR SALE

FOR SALE: Storage tank, 1000 bbls. Riveted. Top and bottom can be inspected. No. 1 condition. $1000. M. J. Reagan, Coffeyville, Kans.

FOR SALE: Approximately 7900' of 3½" OD Drill Pipe with 5" OD Hughes Flash Weld Tool Joints. Practically new. Lawless Drilling Company, Inc., Odessa, Texas. Phone 6-5982.

SHRIVER 42" x 42" cast iron Filter Presses, Plate & Frame Type; 15—Sperry 18" x 18" cast iron Filter Presses, 11 chambers; #12 Sweetland Filters. Immediate shipment. Attractively priced. Consolidated Products Co., Inc., 150 Observer Highway, Hoboken, N. J. N.Y. Tel. BArclay 7-0600.

EQUIPMENT FOR SALE

5 KW OIL FIELD Type light plant—purchased new—used 18 months. MERIDIAN DRILLING CO., INC. Telephone CE 2-2055, Oklahoma City, Oklahoma.

FOR SALE: Happy Coolers for 30, 50, and 80 H.P. Engines. Call Joe Huitt, Deep Rock Oil Corporation, Tulsa.

EVERYTHING in new and used equipment for well drilling. Fishing tools rented. Save money, get quotations from Pressey & Son, Pueblo, Colorado.

FAILING model heavy duty 1500 drill and water truck. Write to Box 819, Longmont, Colorado, for details.

FOR SALE: 1—7¼ x 12 Emsco power pump; 1—6 x 12 Wilson - Snyder power pump; 1—6 x 16 Wilson - Snyder power pump; 1—4 x 6 Wilson - Snyder power pump; 2—20-inch Oilwell steam pumps (one with steel end); 1—20-inch Wilson-Snyder steam pump. All above equipment in first-class condition, located in Houston, Texas. Call T. D. McCandless; Office: CEntral, 7301; Home: MElrose, 6764. P. O. Box 2112, Houston 1, Texas.

FOR SALE: 5½" x 20" class 'Y' Cooper Cylinders, 11" x 16" Superior Cylinders, 8" x 10" XOB Cylinder, Electric Driven Centrifugal Pumps, 125 KW Generator, 4"—500 lbs. rising stem gate valves. Alfred B. Kern, 223 Wright Bldg., Tulsa 3, Oklahoma.

FOR SALE: At our Oklahoma City warehouse. 3150' 10¾" 19.42# new 7/32" wall ARMCO Spiral Weld Line Pipe, plain end, beveled 30° in 50' lengths. Price $1.85 per ft. Take entire quantity. Cities Service Oil. Patridge, Bartlesville, Oklahoma.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

PACKAGED GAS DESULFURIZATION UNITS

All sizes for pipe line and fuel gas requirements.

WRITE—WIRE—PHONE

GRAFF ENGINEERING CO.
3415 Westminster Ave.
Dallas, Texas
Phone Justin 2153

New Steel Pipe

BELOW MILL PRICE

7" O.D.	.317 wall	200 feet
8⅝" O.D.	.352 wall	500 feet
9⅝" O.D.	.385 wall	2,000 feet
16" O.D.	.375 wall	1,460 feet
20" O.D.	.281 wall	1,300 feet
24" O.D.	.281 wall	720 feet
24" O.D.	.406 wall	920 feet
26" O.D.	.281 wall	1,100 feet
26" O.D.	.312 wall	820 feet
26" O.D.	.500 wall	120 feet

All 40 foot lengths
Electric Weld Rejects
Special Low Price

For Immediate Delivery

Write—Wire—Phone

SONKEN - GALAMBA CORPORATION
2nd and Riverview (X-128)
Kansas City 18, Kansas
ATwater 9305

EQUIPMENT FOR SALE

3800' 2⅞" O.D. 6.50# J-55 Rge 2 Hydril Type "A" Thd. Tubing. Arnold Pipe & Supply Co., 3815 Greenwood Rd., Shreveport, La.

$2500.00 will buy 26 Lee C. Moore 67 foot tubular derricks standing on Louisiana Lease. Seymour Van-Os, Box 626, Phone 2351, Kilgore, Texas.

FOR SALE: At Oklahoma City 900' 9" OD 40# 8V Thd. Used seamless steel casing, $3.00 per ft., and 2500' 9" OD 46.10# used seamless steel casing, $3.60 per ft. Cities Service Oil. Patridge. Bartlesville, Oklahoma.

FOR SALE: Two 18-trace sets of Reflection Seismograph instruments, Rack and Panel mounted. One set mounted in instrument cab, on 1951 GMC Truck, model 301-24. Very reasonably priced. Texas Seismograph Co. Box 2069. Phone 3-1493. Wichita Falls, Texas.

TRUCK MOUNTED STEAMERS and pulling units, complete tools, now working. Box G-948, The Oil and Gas Journal, Tulsa, Oklahoma.

250,000 FT. 8⅝ o.d. pipe with collar and plain end. $1.00 per foot Oklahoma. Rogers & Lundquist, 620 Wright Building, Tulsa, Okla. Phone 3-2072—5-8850.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

40 ea. Cable Tool Stems—4" to 5½" O.D. 20 ea. 5½" x 36" Fishing Jars W/3¾" Joints. 95 ea. Bailers—4¼" to 10" O.D.—25' to 70' Lengths. 84 Sand Pumps—Spang—Larkin—Miller—All Sizes. Well Servicing Units—All Sizes—Truck Mounted or Skid Units. RL Cardwell Double Drum Spudder—Excellent Condition. General Tool & Supply Co., Box 4387, Oklahoma City, Oklahoma.

WILL SACRIFICE 75,000' Overstock 5½" OD CASING. 14#—15.5#—17# NEW SMLS. J-55 R2 REG. COLLARS. Box G-966, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: ENGINE—165 Hp. Climax T-61 on Skid. Herndon Drilling Company, 421 Mayo Building, Tulsa, Phone 4-9700.

EQUIPMENT NOT IN USE: Did you find a buyer in this column for the equipment you have for sale. Someone wants it and an "Equipment For Sale" classified advertisement in the Journal will find a buyer. See box heading for classified rates or write The Oil and Gas Journal.

6 LARGE PRODUCTION WELDERS

MOTORS: 160 HP—440 volts—3 phase—60 cycle—1160 rpm—185 amps.—squirrel cage. Manufactured by Century. WELDING GENERATORS: 105 KW—Frame 97—70 volts—1500 amps.—compound wound—Century. In excellent condition.

BARGAIN PRICE! SUITABLE FOR TANK BUILDERS—SHIPYARDS—RAILROADS, ETC.

THE BOSTON METALS CO.
313 E. Baltimore St.
BALTIMORE 2, MARYLAND
CURTIS 7-5050

PIPE YARD—MIDLAND, TEXAS

- Five to 20 acres of land.
- One 5-room house with 2-car detached garage.
- Railroad spur available.
- 280' radio tower (optional).
- Water well.

Call, write or wire:

JIM MYERS or J. T. MILLER
Post Office Box 310, Midland
Phone 2-3711 or 4-6772

EQUIPMENT WANTED

WANTED: Good used 5 x 10 Gardner-Denver mud pump. State condition, price, and location. Would consider pump or pump and motor complete. Box G-965, The Oil and Gas Journal, Tulsa, Oklahoma.

NOTICE: We buy. We sell equipment everywhere. If you want to sell or buy, contact Pressey & Son, Pueblo, Colorado.

WANTED: Used B. S. & B. or National Dehydrator Unit to handle 5 to 10 MMSCF of Gas per day, also same size scrubber, advise location, price and condition by letter, P.O. Box 103, Oklahoma City, Oklahoma.

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

WANTED: Good used 36-L Bucyrus-Erie Spudder. Must be in A-1 condition. E. W. Sauder, Phone 102, Gridley, Kans.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.

LEASE AND DRILLING BLOCKS

WANTED: Small blocks, oil, gas leases, for secondary recovery. Box G-954, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Attractive surface structures in Overton County, Tenn. Seven sands above 1600 feet. Seven rigs drilling in adjoining county. N. M. Sauls, Geologist, Cookeville, Tenn.

CHEAP LEASES & ROYALTIES AVAILABLE: Due to other interests will sell my unproven acres to highest bidders. Wyoming—18,000 acres—leases. North Dakota—2,000 acres—leases. Colorado—480 acres—leases. North Dakota—800 acres—minerals. Write for list. Box G-887, The Oil and Gas Journal, Tulsa, Oklahoma.

320 ACRE PRODUCING OIL LEASE, Kansas, recent well, 1000 acres offset leases, Hunton and Viola production. R. D. Swan, Daniel Building, Tulsa.

$1,000 ½ interest 83A. and 350 ft. well to oil sand near old producer. Good gas sands 600—1000 ft. Line nearby. Gas 20c., S.E. Ohio. 80A. Okla., 200 ft. from new production for drilling deal. Charles Byron, 1071 York, Denver, Colo.

UNUSUAL VENTURE: 220 acres and well drilled. Logs show large oil wells two ways near. 1/32—$125.00; 1/16—$200.00; ¼—$700.00. L. Price, Coweta, Okla.

WILL SELL 320 acre Panhandle oil lease with small producing well. Box 2477, San Antonio, Texas.

LEASES ROYALTIES
Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited

B. D. BUCKLEY
6635 Delmar Ave., St. Louis 5, Mo.

WANT TO SPECULATE

Will sell wildcat oil and gas leases in West Texas County. These leases have four to five years to run. Most of them carry 50c rentals.

These leases are scattered throughout the county and are tracts of 160 acres and more. All leases surrounded by major oil companies.

Big Reef pools already discovered in counties to the south.

1920 total acres at $7.50 per acre.
Box G-937
The Oil and Gas Journal
Tulsa, Oklahoma

LEASE AND DRILLING BLOCKS

NEW MEXICO STATE LEASE, will sell 4,000 acre solid block semi-wildcat, good location. Box G-907, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

SEE A. L. BOWLES, Box 947, Ada, Okla., for attractive drilling deals and producing royalties.

1800A. Colorado State Leases. Baca, Bent, Prowers Co. Near USGS highs. Reasonable. 3000 Acres Drilling Block, East Colorado. Good Geology. Chas. Byron, 1071 York St., Denver, Colo.

FOR SALE: Oil lease, one sand well, drilled and cased. Adaptable to sand-fracturing. Cause, lack of finance. Will sell reasonable. Write or phone F. O. Kaub, Hamilton, Kansas.

12 TO 15 BOPD for sale, two shallow wells, substantial reserves and acreage, new equipment, priced right, eastern Kansas, too far from our operation. Francis Claus, Union Trust Bldg., Rochester 14, N. Y.

480 ACRE drilling block, Township 5, Range 20, Beaver County, Oklahoma. On direct trend with Huber, Light, and Texas Company, Cook, Johnson, and Eldridge wells. E. H. Huebner, Turpin, Oklahoma.

LOOKING FOR A LEASE? There will be over 40,000 wells drilled this year. If you are looking for a lease, drilling block, or drilling deal and haven't found it in this column, or if you have a lease or drilling block you want drilled, a Journal classified advertisement can find an interested party. See box heading for classified rates, or write The Oil and Gas Journal.

ELECTRICAL CONTRACTORS

Office Phone 5-5315 — Res. Phone 7-4950

W. L. RATCLIFF COMPANY
ELECTRICAL CONTRACTORS
Industrial—Commercial—Distribution

W. L. Ratcliff, P. O. Box 373 — 508 Caddo St, Shreveport, La

PRODUCTION WANTED

WANTED
SETTLED OIL PRODUCTION

Independent operator wishes to buy up to 350 barrels per day production, Kansas, Oklahoma, Texas or Louisiana. Send full particulars and price first letter. Engineers report will be required before purchase is completed. Will deal with owners or brokers. Box G-942, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

CASH AVAILABLE
For Purchase of Producing Oil & Gas Properties

Principals require attractive investment opportunities. Complete information necessary.

Box G-854
The Oil and Gas Journal
Tulsa, Oklahoma

ROYALTIES

OFFERING CHOICE ROYALTIES on geology in Oklahoma's greatest oil fields. A. S. Berry, 522 Wright Bldg., Phone 5-5402 Tulsa, Oklahoma.

GET TOGETHER: Both Capital and Royalties are available. If the investment proposition you want isn't listed in this column, use a Journal classified advertisement to find it. See box heading for classified rates, or write The Oil and Gas Journal.

REAL ESTATE

80,000 ACRES: Mineral timber land, Tennessee—$3.50 per acre, all mineral rights. Details—E. Jester, 12744 Vanowen, North Hollywood, California.

SPACE IS NEEDED: A Journal display classified advertisement is the quickest way to rent or sell your real estate. In the present period of expansion oil industry firms urgently need the space you nave available. If it isn't listed here, you may also find it by stating your needs in these pages. For classified rates see box heading or write The Oil and Gas Journal.

PRODUCTION

PRODUCING WATER FLOOD PROPERTY FOR SALE

Sealed bids will be received at the offices of C. L. Sutton, 1001 First National Building, Tulsa, Oklahoma, not later than 2 P.M., March 11, 1954, for the purchase of the water flood property formerly owned by Brundred Oil Corporation, located two miles south of Garnett, Kansas. Said properties consist of a net average Working Interest of 79% in 300 acres fully developed for water flood operation, now producing 30-35 barrels net oil from some 315 wells. Complete water supply plant, water supply well and necessary distribution system go with property. For further information, contact C. L. Sutton at above address.

FOR SALE OR LEASE

TWO TRAILER CAMPS: Each camp composed of seven trailers, utility truck, water truck and power plant truck. Each camp accommodates 28 men. United Geophysical Company, 1554 California Street, Denver, Colorado.

EQUIPMENT MEN

(Continued from page 144)

Coe Named Manager, Steel Valve Sales by Kerotest

R. H. COE

The appointment of Russell H. Coe as sales manager for steel valve sales, has been announced by R. B. Tullis, president of Kerotest Manufacturing Co., of Pittsburgh.

Coe has been associated with the pipe-line supply business for over 25 years. Starting with Youngstown Sheet & Tube Co. in 1929 as a test engineer, he progressed to sales engineer 2 years later. In 1939, Coe joined Pipe Line Service Corp. as a sales engineer. In 1945, he was made vice president of the firm.

From 1949 to 1951, Coe assisted Pittsburgh Coke & Chemical in starting its protective-coatings division, and then went into business for himself. In 1953 he joined Kerotest as sales representative in Pittsburgh, which position he held until his recent promotion.

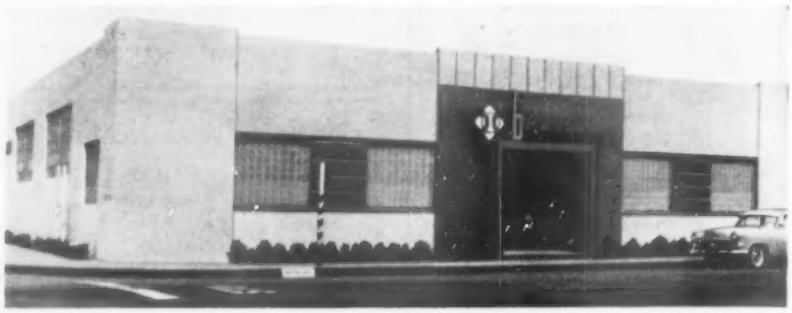
Homco Names Roach Rocky Mountain Area Manager

C. L. (Hal) Roach has been designated as area manager of the Rocky Mountain area for Houston Oil Field Material Co., Inc.

Roach, a long time employe of Homco, has been in the sales department, but under the new designation, he is responsible for the services as well as the sales. His headquarters will be in Denver. Homco service points are located at Casper, Wyo., and Williston, N. D.

Hoyt Johnson is in charge of service operations at Casper and Williston, and will work with Roach to coordinate both sales and services.

Barksdale Valves Moved to New Plant



L. S. Barksdale, president of Barksdale Valves, has announced that the move of the assembly plant and the general offices to new facilities has been completed. These larger facilities, in Los Angeles, were acquired to keep pace with the increasing demand for hydraulic control equipment in the industrial field. Barksdale Valves manufactures and distributes a complete line of Shear-Seal manual and solenoid valves, and pressure-actuated switches to supply the vital link between electric and hydraulic circuits.

Brown to Head Barnes Pump Sales to Oil Industry

F. D. BROWN

Ford D. Brown, formerly with Eco Engineering Co., has been named manager of petroleum and industrial pump sales for Barnes Manufacturing Co., Mansfield, Ohio, and Oakland, Calif.

According to F. B. Hout, vice president in charge of sales for Barnes, Brown has been closely allied with the petroleum industry for the past 15 years, having been associated not only with Eco Engineering Co., but having served as sales manager of the industrial pump division of Bowser, Inc., and as district sales manager for Blackmer Pump Co.

Ryerson to Distribute Carlon Plastic Pipe

Joseph T. Ryerson & Son, Inc., steel service organization, is now distributing plastic pipe and fittings produced by Carlon Products Corp., Cleveland, according to J. L. McDermott, manager of the industrial plastics division of the Ryerson company. Service on these products is available through the 16 Ryerson steel service plants located in major industrial areas across the country.

McDermott said that both flexible and rigid Carlon plastic pipe is being sold by his division, in a number of compositions, for use in all types of low-pressure lines handling liquids, highly corrosive fluids, gases, vapors, and wastes. In addition to plastic pipe and fittings supplied from stock, he said that service is available on custom-produced plastic pipe for special installations. He added that the Carlon line of plastic products supplemented the Ryerson company's laminated industrial plastic supplied in sheets, tubes, and rods.

Koppers to Build New Development Laboratory

Construction of a new mechanical development laboratory, devoted to the refinement and adaptation of present products and processes plus the development of new products for Metal Products division of Koppers Co., Inc., has been announced by Walter F. Perkins, vice president and general manager of the division.

The new laboratory will be located at Koppers' South Baltimore plant. Personnel and operations of the new laboratory will be directed by John W. Pennington, manager of the division's technical department.

More than 50 engineers, technicians, draftsmen, mechanics, and machinists will staff the laboratory. Physical facilities of the new laboratory will consist of a research library; a drafting room; offices for administrative personnel; electrical, mechanical, electronics and instrument, and dynamometer laboratories; and a large machine shop and tests area.

Hughes to Manage New Fishing Tool Shop

The Great Bend Fishing Tool Co., of Great Bend, Kans., affiliated with Acme Oil Tool Co., of Oklahoma City, recently announced the appointment of C. N. Hughes as manager of its new fishing-tool shop at Liberal, Kans.

Hughes has 30 years' experience in the oil fields, having worked as a roustabout, pumper, roughneck, driller, tool pusher, and fishing-tool operator prior to his appointment as manager in Liberal.

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LEGAL

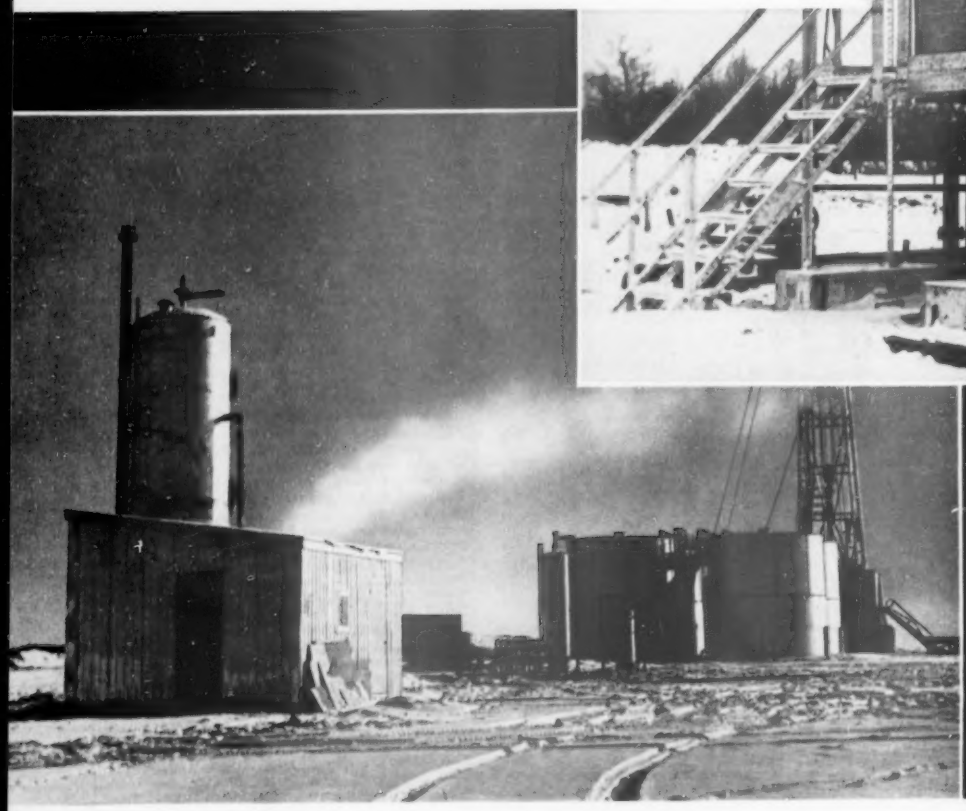
Sealed bids for Oil and Gas Mining Leases on restricted Tribal and Allotted lands of the Fort Berthold Indian Reservation, North Dakota, will be received at the Office of the Superintendent of the said reservation, New Town, North Dakota, until 2:00 P.M. Central Standard Time on March 16, 1954, and will be opened immediately thereafter in the presence of such bidders as may attend. There are 320 acres of Tribal lands and 26,795.675 acres of allotted lands for a grand total of 27,195.675 acres. All of this land is located in the county of Dunn, State of North Dakota. For additional information write the Superintendent of the Fort Berthold Agency, New Town, North Dakota, or call the Agency Land Office, Phone 654, New Town. Ralph M. Shane, Acting Superintendent.

LEGAL

1,280.28 acres of Allotted Indian lands, in 29 separate tracts, located on the Uintah and Ouray Indian Reservation, Townships 1 and 2 North, Ranges 1 East and 1 West, Uintah Special Base and Meridian Survey, Uintah County, State of Utah, are being advertised for oil and gas lease sale, bids on which will be opened 2:00 P.M., March 16, 1954, at the Uintah and Ouray Agency, Harry W. Gilmore, Superintendent, Fort Duchesne, Utah. Full particulars may be obtained from the office of the Regional Oil and Gas Supervisor, U. S. Geological Survey, Casper, Wyoming, or from the Uintah and Ouray Agency.

National

TANK ENGINEERS SOLVE CRUDE HEATING PROBLEMS IN LEDUC FIELD



SOUTH LEDUC—4' x 27½' "YCP" 15# National Treater

LEDUC—4 Hi-500 Bbl. National Bolted Steel Tanks

1 6' x 20' "YIWP" 15# National Treater

1 2C, 2½' x 13' 125# National Separator

1 NC, 2' x 6' 125# National Separator

Instead of expensive boiler installations, many Canadian operators are turning to National Treaters to maintain crude pour point under extreme weather conditions. Temperatures as low as 60° below zero, inadequate water supplies, frequent shut-downs, oil loss through steam heat evaporation were the difficulties that led National engineers to a practical and economical solution.

By re-designing piping hook-ups and circulation lines, by putting crude in at the bottom of the tanks and by installing a National Treater instead of a boiler, all difficulties of maintaining pour point have been eliminated. Crude is circulated from tanks through treaters. Unlike boilers, National Treaters require very little water.

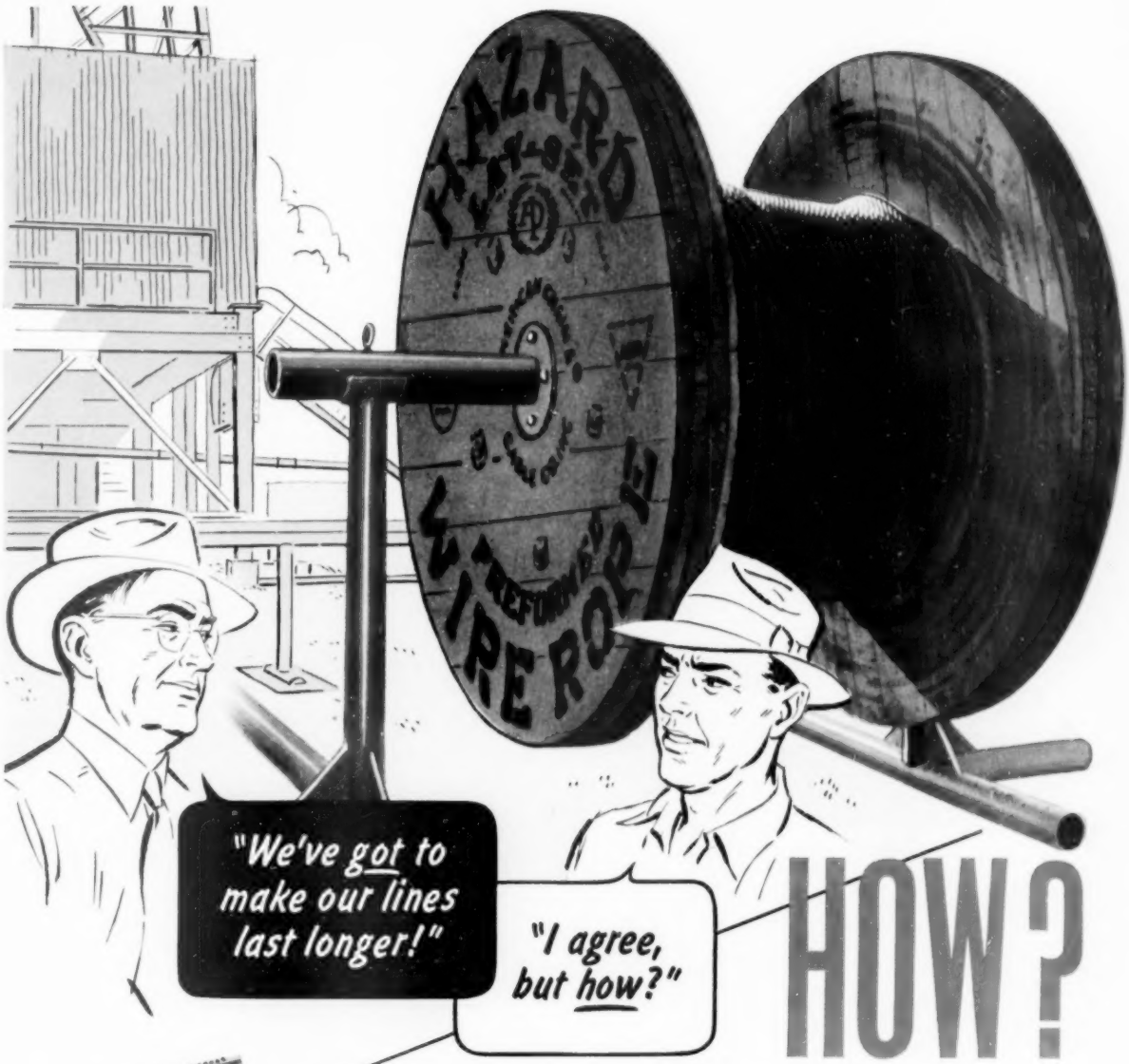
They can be shut down for several days without draining without fear of freeze-up. If a longer shut-down is necessary, water can be drained quickly. Refilling to go back into operation can be done easily and at a minimum cost.

It's a National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

1-2-53



—with HAZARD's Ton-Mile Plan

If you will put HAZARD'S TON-MILE PLAN into effect on your rigs, you'll surprise yourself when you see how much longer your drilling lines last. There's nothing complicated or mysterious about this plan, and once you start it, you'll realize how much you have paid in the past for service you didn't get.

HAZARD'S TON-MILE BOOK outlines the system you must follow. It tells how much line to string up. It tells you when to cut off and how much. The simplified ton-mile tables and safety factor charts are easy to understand and use. The service record sheets are 8½" x 11" with plenty of room for all entries. And the thick triple covers with spiral wire binding keep the book neat and clean for a long time.

See your HAZARD distributor at once. Let him give you the facts on LAY-SET Preformed drilling lines. Have him explain HAZARD'S TON-MILE PLAN, then put it into effect on your rigs. See how much longer your HAZARD lines last.

HAZARD WIRE ROPE DIVISION
American Chain & Cable Company, Inc.

Wilkes-Barre, Pa., Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

economics

BEHIND YOUR CHOICE OF ROCK BITS

In oil well drilling, the margin between *profit* and *loss* may frequently be the difference in the performance of the rock bits you use.

That is why so many operators today select Hughes bits in setting up bit programs for their wells. They know from experience that in established areas they can project drilling costs from the performance of Hughes bits.

Let the Hughes representative in the area in which you are operating help you set up the bit program on your next well. He is familiar with the bits that can get you on and off the job in the shortest possible time.